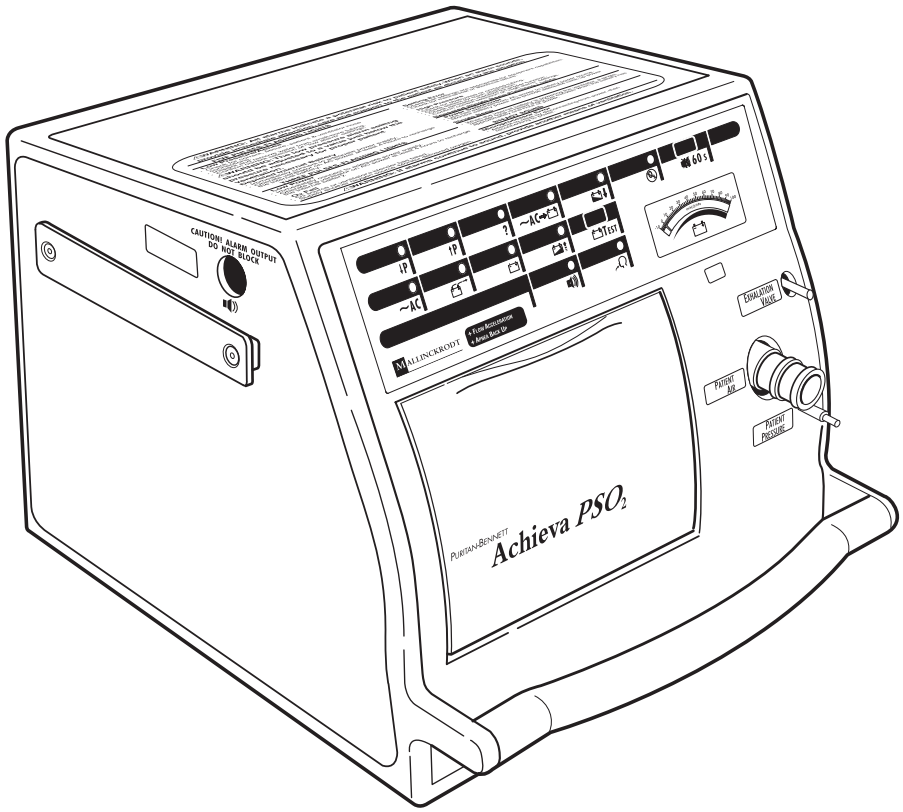
Achieva

User's Manual

Ventilator with Flow Acceleration Limit and Apnoea Backup



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CHAPTER 1

Safety Information

1.1 Definitions

This manual uses three indicators to highlight information of particular importance. They are:

Warning

Indicates a condition that can endanger the patient or the ventilator operator.

Caution

Indicates a condition that can damage the equipment.

NOTE:

Indicates points of particular emphasis that make operation of the ventilator more efficient or convenient.

1.2 Warnings and Cautions

This section lists general warnings and cautions for your safety and that of the patient.

Warning

- Read all of this manual before using the ventilator.
- Anything that damages the ventilator may cause danger to the patient.
- Do not use your ventilator until you have been properly trained by your clinician and have read and understand this manual.
- Make sure you can hear the ventilator's alarm from other areas of the house, and when you are using appliances such as a vacuum cleaner, dishwasher, clothes dryer, television, or radio.
- Do not use the ventilator if you suspect it may not be working properly. Contact your clinician to have the ventilator tested or replaced.
- If the patient's condition warrants the use of an independent secondary alarm or a back-up means of ventilation, the clinician should prescribe it.
- Wash your hands thoroughly before and after handling patient connectors and other accessories.
- Always check the ventilator's breath delivery settings before using the ventilator with a patient. When adjusting settings, special care should be taken to ensure that the new settings are correct. The use of incorrect settings during ventilation can endanger the patient.

Warning

- To avoid a fire hazard, keep matches, lighted cigarettes, and all other sources of ignition (such as flammable anesthetics and/or heaters) away from the *Achieva* ventilator system and oxygen hoses.
- Do not use hoses that are worn, frayed, or contaminated by combustible materials such as grease or oils.
- In case of a burning smell, immediately disconnect the ventilator from the oxygen supply, AC power, and backup power source.
- All alarms indicate a potential risk to patient safety. When an alarm sounds, provide immediate attention, care, and support to the patient as dictated by the situation.
- Any device is subject to unpredictable failures. To ensure patient safety, an appropriately trained caregiver should monitor ventilation.
- If the patient's condition warrants the use of an independent secondary alarm, remote alarm, or another external monitoring device, the physician should prescribe it. The physician should also determine if the patient requires an alternate means of ventilation.
- Certain types of ventilators, including the *Achieva* Series, have a Low Inspiratory Pressure Alarm. The purpose of this alarm is to alert the clinician or caregiver when the pre-set alarm parameters are violated. As set forth in the *Achieva* Series Clinician's and User's Manuals, a number of environmental factors and circuit accessories/components can affect the pressure in the breathing circuit. These factors may prevent circuit pressure from violating the low-pressure parameters, even in the event of a circuit being disconnected from the patient. Therefore, it is important for the clinician to consider and monitor these environmental factors when establishing pressure alarm parameters. Depending on the specific clinical situation (such as when the risk of disconnect is perceived as high and the patient is ventilator-dependent), a secondary means of monitoring ventilation, such as pulse oximetry, should be considered.

Caution

- Do not attempt to make any repairs or otherwise service the ventilator. Contact an authorized service representative for any service needs.
- Do not use or store this ventilator in the presence of strong electromagnetic fields, such as an MRI environment.

CHAPTER 2

Overview

2.1 Intended Use

This device is intended to provide ventilatory support for pediatric and adult patients who require positive pressure mechanical ventilation. Patients should weight no less than 11 lbs (5 kg).This device is for use in home, institutional, and portable settings.

This device is contraindicated for use with anesthetic gases. This device is intended to be used on the order, and under the supervision, of a physician.

2.2 Role of Your Clinician

In this manual, the term *clinician* means the trained health-care professional who is helping you use the Achieva ventilator in your home. This may be a doctor or nurse who is treating your patient, or some other trained health-care professional.

Your clinician will:

- Order a ventilator for use in your home
- Train you to use the ventilator
- Help you to set up the ventilator
- Select appropriate accessories to use with your ventilator
- Show you how to respond to alarms
- Answer your questions about using the ventilator
- Follow up with you on a regular basis to make sure the ventilator is meeting your needs

2.3 How the Ventilator Works

2.3.1 Overview of Ventilation

A ventilator - like the Achieva ventilator you are about to use - is a device that is designed to assist the patient by moving air into their lungs and providing adequate ventilation.

2.3.2 Important Terms

You should be aware of the following terms that will appear frequently throughout this manual.

Mode: The manner or method of ventilatory support provided by the ventilator.

Volume: The amount of air delivered to the patient with each breath.

Pressure: A measure of the pressure required to “push” air into the patient’s lungs.

Respiratory Rate: The number of breaths per minute.

2.3.3 Modes of Ventilation

The following is a general description of the various modes of ventilation available with the Achieva ventilator. It is up to your clinician to determine which modes are appropriate for your patient.

2.3.3.1 Assist/Control (A/C) Mode

In Assist/Control mode, machine-initiated breaths are delivered at a clinician-set volume or pressure, inspiratory time, and rate. If the patient triggers a spontaneous breath between machine breaths, the ventilator will deliver a breath based on the volume or pressure settings. Whether initiated by the patient or the ventilator, all breaths are delivered at the same pre-set volume or pressure.

2.3.3.2 SIMV Mode

In SIMV (Synchronized Intermittent Mandatory Ventilation) Mode, machine-initiated breaths are delivered at a clinician-set volume, inspiratory time and rate. These mandatory breaths are synchronized with patient effort. If the patient triggers a spontaneous breath between machine breaths, the ventilator will deliver a spontaneous breath, which can be pressure-supported. Spontaneous breaths in SIMV do not have a pre-set volume or pressure.

2.3.3.3 Spontaneous (SPON) Mode

In Spontaneous mode, breaths are delivered with a volume, pressure and rate that are determined by the patient. Spontaneous mode is most frequently used with either CPAP (Continuous Positive Airway Pressure) or a combination of PS (Pressure Support) +CPAP.

2.3.3.3.1 CPAP

In CPAP, the ventilator maintains a constant level of pressure in the patient's airway. This can help to improve oxygenation, or the level of oxygen in the patient's blood. If your clinician has prescribed CPAP, you should talk to him or her for a further explanation of how CPAP works.

2.3.3.3.2 PS+CPAP

Like CPAP, PS+CPAP maintains a constant level of pressure in the patient's airway. In addition, the ventilator applies a clinician-set pressure to each of the patient's breaths. This has the same benefits as CPAP, with the additional benefit of assisting the patient in moving air into the lungs.

CHAPTER 3

Description

3.1 Model Number

The Achieva's model number is printed on the front door panel. There are certain features described in this manual that only pertain to certain models.

3.2 Symbols

Table 3-1 lists the symbols that are used on the Achieva system.

Table 3-1: Symbols

Symbol	Description
Regulatory	
CE 0123	CE mark: This device complies with the requirements of Directive 93/42/EEC concerning medical devices.
	Type BF equipment, degree of protection against electrical shock
	Classified by Underwriters Laboratories Inc. with respect to electric shock, fire and mechanical hazards only in accordance with UL2601-1
	Certified by Canadian Standards Association to meet CAN/CSA C22.2 No. 601.1-M90
Caution/Warning/Safety	
	Attention, consult accompanying manual
	Keep dry
	Fragile
Alarm Indicators	
	Alarm indicator
	Low Pressure/Apnoea LED alarm indicator
	High Pressure LED alarm indicator
?	Setting Error LED alarm indicator

Table 3-1: Symbols (continued)

Symbol	Description
~AC⇒🔋	Power Switch-Over LED alarm indicator
🔋↓	Low Power LED alarm indicator
O_2	O_2 Fail LED alarm indicator
🔊	Alarm Control LED indicator
Power Indicators	
~AC	AC (alternating current) LED power source indicator
🔋→	External Battery LED power source indicator
🔋	Internal Battery LED power source indicator
🔋↑	Battery Charging LED indicator
Electrical	
~AC	Alternating current
⎓	Direct current
V	Volts
A	Amperes
Keys	
⏻	Standby mode of operation
🔇 60 S	Alarm Silence/Reset key
🔋 TEST	Test Battery key
MODE	Mode selection key
MENU/ESC	Menu/Escape function selection key

Table 3-1: Symbols (continued)

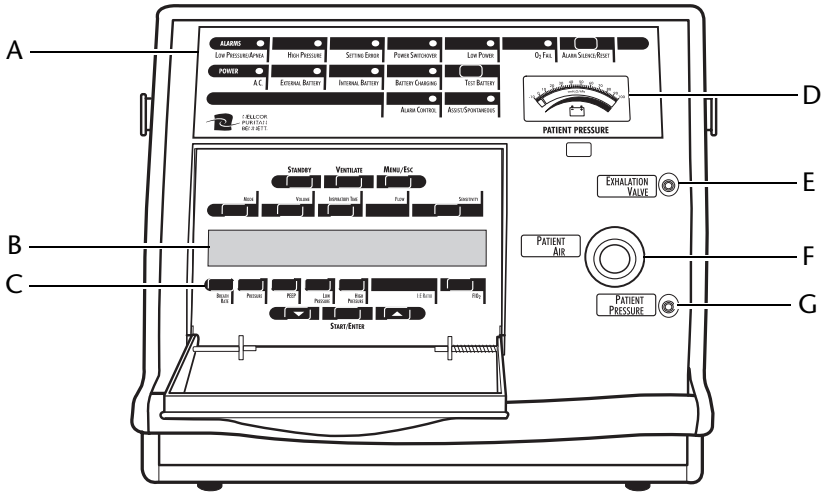
Symbol	Description
△	Up Arrow key
▽	Down Arrow key
V_t	Volume parameter setting key
T_i	Inspiratory Time parameter setting key
f	Breath Rate parameter setting key
P	Pressure Support parameter setting key
PEEP	Positive End Expiratory Pressure parameter setting key
P↓	Low Pressure alarm setting key
P↑	High Pressure alarm setting key
SENS.	Sensitivity parameter setting key
O_2%	F_IO_2 (oxygen) parameter setting key
↵	Start/Enter function setting key
	Ventilate function setting key
Displays	
I/E	I/E Ratio LCD
$\dot{V}$	Flow LCD
Labels and Connectors	
IPX1	Drip proof
	External Battery power connector

Table 3-1: Symbols (continued)

Symbol	Description
Miscellaneous Indicators	
	Assist/Spontaneous LED indicator

3.3 Front Panel

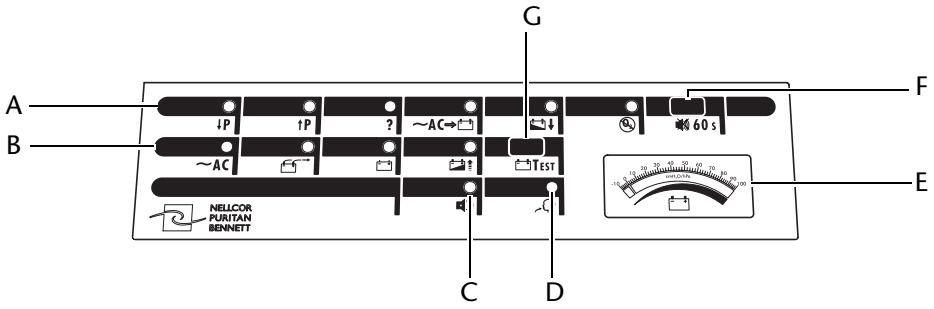
Figure 3-1. Front Panel



A. Top Panel
B. Liquid Crystal Display (LCD)
C. Door Panel (open to reveal Display and Controls)
D. Patient Pressure Meter
E. Exhalation Valve Port
F. Patient Air Port
G. Patient Pressure Port

3.3.1 Top Panel

Figure 3-2. Top Panel



A. Alarms Indicators
B. Power Indicators
C. Alarm Control Indicator
D. Assist/Spontaneous Indicator
E. Patient Pressure Meter
F. Alarm Silence/Reset Key
G. Test Battery Key

A. Alarms Indicators

The ventilator's Alarms Indicators will flash when an alarm condition is detected. The indicators are turned off *only* when the condition is *corrected*, and the ALARM SILENCE/RESET key is pressed. Alarms Indicators exist for the following alarm conditions:

P↓ – Low Pressure/Apnoea

P↑ – High Pressure

? – Setting Error

~AC⇒ – Power Switch-Over

– Low Power

O_2 – O_2 Fail (Achieva PSO_2 only)

These alarm conditions will be explained later in this manual. For now, be sure to familiarize yourself with the location of the Alarms Indicators.

NOTE:
For the Achieva and Achieva PS models that do not have the oxygen function, the O_2 FAIL alarm indicator position is present; however, the position is empty and unlabeled.

B. Power Indicators

The ventilator's Power Indicators show which electrical source the ventilator is currently using and if the internal battery is being charged. Power Indicators exist for the following power conditions:

~AC – AC

– External Battery

– Internal Battery

– Battery Charging

These power conditions will be explained later in this manual. For now, be sure to familiarize yourself with the location of the Power Indicators.

C. Alarm Control Indicator

The ALARM CONTROL indicator flashes when the audible alarm has been presilenced, but is lit continuously when the nonlatching alarm feature is active. You will learn more about pre-silencing alarms later in this manual.

D. Assist/Spontaneous Indicator

The ASSIST/SPONTANEOUS indicator lights when the patient's breathing effort meets or exceeds the ventilator's sensitivity setting.

E. Patient Pressure Meter

The PATIENT PRESSURE meter (Figure 3-2, item "E") shows the level of pressure that is currently in the patient circuit.

F. Alarm Silence/Reset Key

60S The ALARM SILENCE/RESET key silences the audible alarm during an alarm condition and can be used to pre-silence the audible alarm for a period of 60 seconds. If an alarm condition occurs while the 60-second pre-silence period is in effect or while ALARM SILENCE/RESET is active, the front panel LCD (Figure 3-1, item "B") will display the alarm condition, but the alarm will not sound. This key can also be used to reset an alarm after the alarm condition has been corrected.

G. Test Battery Key

TEST When the TEST BATTERY key is pressed and held, the PATIENT PRESSURE meter (Figure 3-2, item "E") shows the charge level of the battery currently in use.

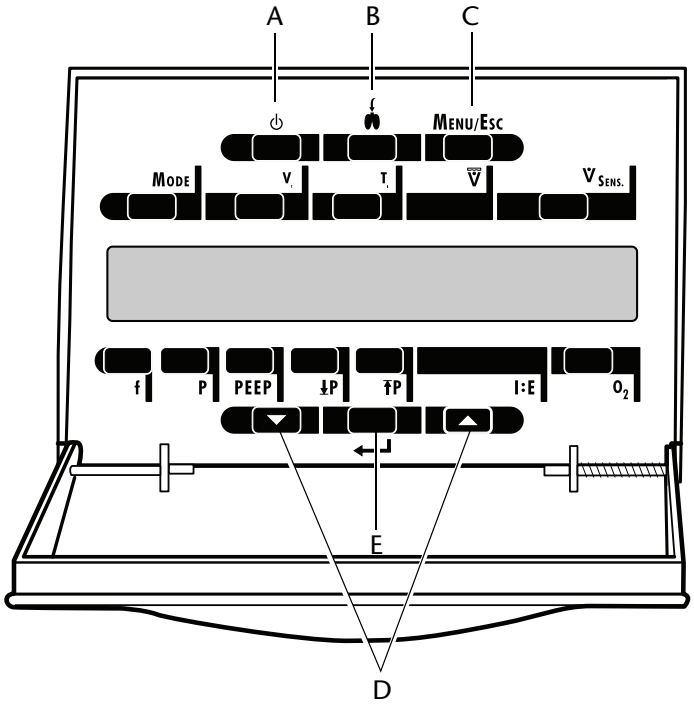
3.3.2 Door Panel

The display and control panel is located behind the ventilator's front door panel (Figure 3-3). This front door panel is magnetically latched to prevent tampering and accidental resetting when closed.

The following is a brief explanation of each of the controls. Further information regarding how and when you should use the controls will be provided later in this manual.

General Controls

Figure 3-3. Door Panel General Controls



A. Standby key
B. Ventilate key
C. Menu/Escape key
D. Up and Down Arrow keys
E. Start/Enter key

A. Standby

⏻ When pressed and held for three (3) seconds, the STANDBY key causes the ventilator to stop delivering air.

B. Ventilate

Pressing the VENTILATE key causes the ventilator to begin delivering air.

C. Menu/Escape

MENU/ESC Pressing the MENU/ESC key activates the menu options on the ventilator's display.

D. Up Arrow and Down Arrow

▽ △ The UP ARROW and DOWN ARROW keys are typically used to move between values displayed in the ventilator's LCD window (Figure 3-4, item "R"). While a ventilator setting is flashing, pressing the up and down arrow keys will increase or decrease the flashing setting's value. While the ventilator's menu options are active, pressing the up and down arrow keys allows you to move between menu levels. If none of the ventilator's settings are flashing, and the menu

options are not active, pressing the up or down arrow keys will cause the last alarm message to be displayed in the LCD window.

E. Start/Enter

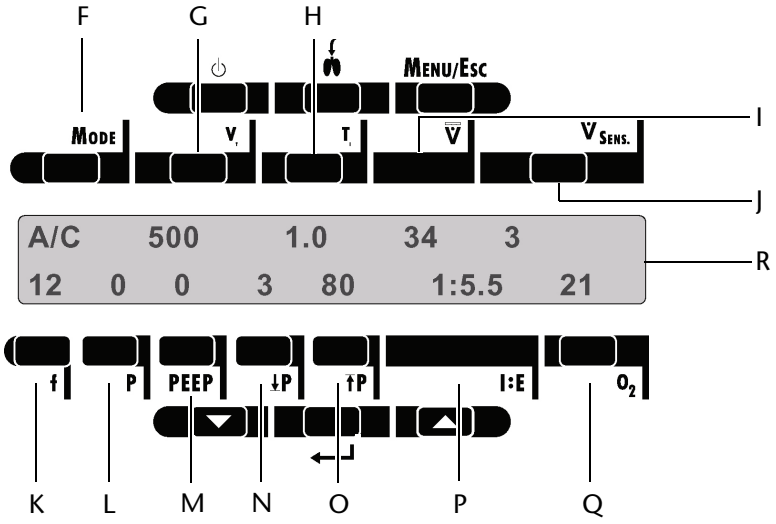
If the ventilator is in Standby, pressing the START/ENTER key (Figure 3-3, item "E") will activate the display in the LCD window (Figure 3-4, item "R"). START/ENTER is also used to accept a flashing setting value.

Setting the Controls and Display

You can select a setting by pressing the corresponding setting control key. Selecting a setting will cause the current setting value to flash in the LCD window (Figure 3-4, item "R"), allowing for adjustment of the setting value.

Each setting value displayed in the LCD window corresponds with the control nearest it (above or below.) Values displayed in the top row correspond to the row of controls located directly above the LCD window. Values in the bottom row correspond to the controls directly below the window.

Figure 3-4. Door Panel Setting Controls and Display

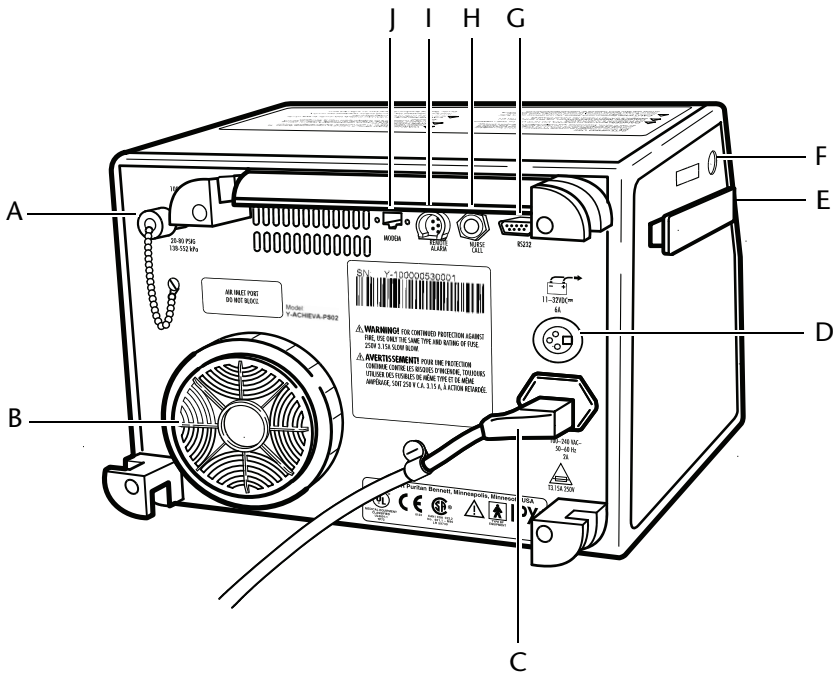


NOTE: The I:E Ratio and Flow settings do not have keys. These controls are labeled for display purposes only. Refer to Figure 3-4.

F. Mode key
G. Volume key
H. Inspiratory Time key
I. Flow LCD
J. Sensitivity key
K. Breath Rate key
L. Pressure key
M. PEEP key
N. Low Pressure key
O. High Pressure key
P. I:E Ratio LCD
Q. FiO_2 key (Achieva PSO2 only)
R. LCD Window

3.4 Rear and Side Panels

Figure 3-5. Rear and Side Panels



A. Oxygen Input Connector (Achieva PSO_2 only)
B. Inlet Filter
C. Power Cord Connector
D. External Battery Connector
E. Side Rail
F. Audible Alarm Port
G. Communications Connector
H. Nurse Call Output Connector
I. Remote Alarm Connector
J. Modem Connector (Achieva PS and PSO_2 only)

Warning

Do not block the Audible Alarm Port on the left panel of the ventilator (refer to Figure 3-5, item “F”).

3.5 Power Supply

The Achieva ventilator can use any one of the following power sources:

- AC power
- External 12- or 24-volt DC battery
- Internal battery

3.5.1 AC Power

NOTE:

- Whenever possible, the ventilator should be plugged in to an AC power outlet. This allows the ventilator to maintain its internal battery charge.
- All three power sources can be connected to the ventilator at the same time; if AC power fails, the ventilator will automatically switch to the next best power source.

When the ventilator is plugged in to a functioning wall outlet, it automatically selects the AC power source and will operate indefinitely on AC power. While the ventilator is operating from AC power, the AC power indicator (on the top panel) is lit.

3.5.2 External Battery

An external battery should be used as a backup power source, in case of AC power failure (such as a power outage in your home.) An external battery may also be required when AC power is unavailable (such as while the patient is in a wheelchair, car or other vehicle.) While the ventilator is operating from the external battery, the EXTERNAL BATTERY power indicator (on the top panel) is lit.

3.5.3 Internal Battery

NOTE:

The internal battery will automatically charge while the ventilator is connected to an AC power source and is operating in any mode, including Standby.

The ventilator has an internal battery that is capable of powering the ventilator for a limited time. The internal battery should only be used if an AC power source or an external battery is not available. You should not rely on the internal battery as the sole backup power source for your ventilator.

The ventilator will automatically switch to its internal battery when other power sources fail or drop below adequate levels. The POWER SWITCH-OVER alarm signals whenever the ventilator switches from AC or an external battery to its internal battery.

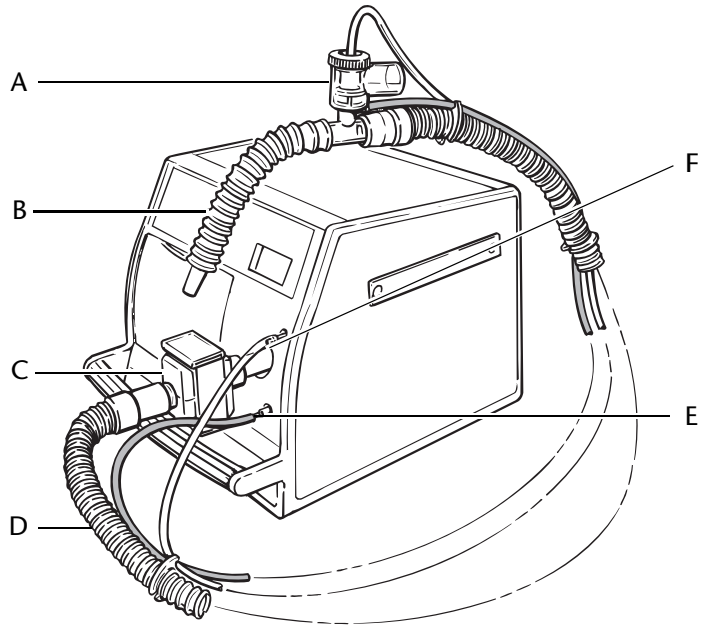
While the ventilator is operating from its internal battery, the INTERNAL BATTERY indicator on the top panel is lit. As the battery nears depletion, the ventilator will sound one of the following audible alarms to signal that you should provide another power source.

- *Low Internal Battery Alarm:* When approximately 45 minutes of power remains, the ventilator's alarm will sound a *single beep every five minutes*.
- *Extremely Low Internal Battery Alarm:* When approximately 10 minutes of power remains, the LOW POWER indicator *flashes* and the *alarm sounds three pulses*. The alarm continues until an external power source is connected. You can silence the alarm for five-minute intervals by pressing the ALARM SILENCE/RESET key.
- *Battery Charge Depleted (ventilator continues to operate):* When the internal battery is nearly depleted, the LOW POWER indicator continues to *flash* and the *alarm sounds five pulses*. The ventilator alarm continues until an external power source is connected. You cannot silence a Battery Charge Depleted alarm until after you connect an alternate power source.

3.6 Patient Circuit

The patient circuit consists of the parts shown in Figure 3-6.

Figure 3-6. Patient Circuit



A. Exhalation Manifold
B. Flex Tube
C. Bacteria Filter
D. Patient Air Tube
E. Patient Pressure Tube
F. Patient Exhalation Tube

A. Exhalation Manifold

The exhalation manifold controls the flow of air to and from the patient.

B. Flex Tube

The flex tube connects the patient circuit to the tracheostomy tube. The flex tube is made of flexible material that makes the circuit more comfortable for the patient.

C. Bacteria Filter

The bacteria filter cleans the incoming air before it is delivered to the patient.

D. Patient Air Tube

This is the large tube between the bacteria filter and the exhalation manifold.

E. Patient Pressure Tube

This small tube connects the patient pressure port on the ventilator to the exhalation manifold.

F. Exhalation Tube

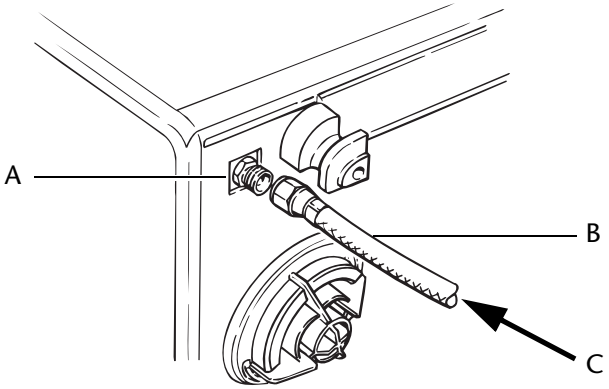
This small tube connects the exhalation valve port to the exhalation manifold.

3.7 Supplemental Oxygen

NOTE: Your clinician will determine if supplemental oxygen is required and will provide the proper instructions.

If you are operating an Achieva model PSO_2 ventilator, the ventilator has an optional internal oxygen blender. This means an external oxygen source can be connected to the oxygen input connector on the back of the ventilator. Refer to Figure 3-7.

Figure 3-7. Connecting the Oxygen Supply



A. Oxygen Input Connector
B. Oxygen Line
C. Oxygen flow from external source

Two other methods of delivering supplemental oxygen are available:

- Oxygen Enrichment Kit
- 90° Elbow with Oxygen Fitting

3.7.1 Oxygen Enrichment Kit

Your clinician may prescribe an Oxygen Enrichment Kit (OEK), which can be connected to the air inlet port on the back of the ventilator. The OEK comes with complete instructions for set up and use.

3.7.2 90° Elbow with Oxygen Fitting

Warning

If you are using the 90° elbow to deliver supplemental oxygen, care should be taken to securely attach the oxygen line to the elbow's oxygen fitting. If the oxygen tube becomes disconnected from the 90° elbow, the drop in pressure may not be significant enough to sound the ventilator's Low Pressure Alarm. This means that the patient may not receive the prescribed levels of oxygen and the tidal volume may be decreased, but you may not be alerted by the ventilator's audible alarm system. To prevent this, you should push the oxygen line tubing as far down on the elbow's oxygen fitting as possible, to reduce the possibility of inadvertent disconnection.

Your clinician may prescribe the use of a 90° elbow with an oxygen fitting. The 90° elbow releases controlled amounts of oxygen directly into the patient circuit. The elbow should be connected between the bacteria filter and the patient circuit. A low-pressure oxygen line can then be connected to the fitting on the elbow. Your clinician will provide you with complete instructions for using the 90° elbow and the oxygen source.

3.8 Humidification Devices

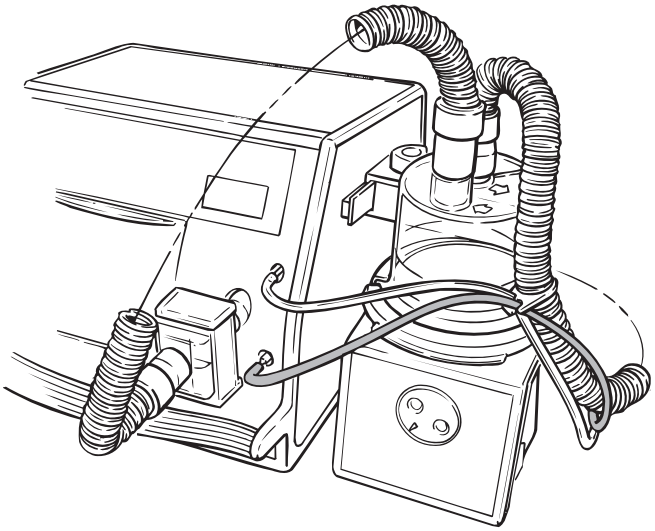
Your clinician may prescribe that the air be humidified before it is delivered to the patient. Air can be humidified by passing it through a heat and moisture exchanger (HME), an "artificial nose" device (used for short term humidification), or a humidifier (see Figure 3-8). You should follow the device manufacturer's instructions for connecting any of these devices to the patient circuit.

Follow these safety guidelines when using a humidification device with your ventilator:

Warning

- Always position a humidification device so that it is lower than the patient.
- Do not place a humidifier on top of or above the ventilator.
- Using an HME or an "artificial nose" may affect the ventilator's low pressure alarm setting. See section 4.7, "Setting the Low Pressure Alarm," on page 4-7.
- If a heated humidifier is used, you should always monitor the temperature of delivered air. Air that becomes too hot may burn the patient's airway.

Figure 3-8. Achieva Ventilator Connected to a Humidifier



When a humidification device is used, condensation may form in the patient circuit over time. You should regularly check the patient circuit for signs of condensation. If you notice moisture in the patient circuit, you should disconnect and drain the circuit or replace it with a dry circuit.

Refer to the humidification device's instruction manual for operating, cleaning, and sterilization instructions.

CHAPTER 4

Set Up

4.1 Preparing the Ventilator

To function properly, your Achieva ventilator needs the following items Make sure you have these items before proceeding.

- Power Source (AC power outlet or external battery)
- Inspiratory filter
- Patient circuit
- Air inlet filter
- Means of connection to the patient (such as an endotracheal tube, tracheostomy tube, or mask)

1. Before using your ventilator, inspect the device. Verify the following.
   - The power cord does not have any kinks, breaks or damaged insulation.
   - The connectors, rubber feet, filter housings, and so on, are not loose or broken.
   - The outer casing does not have any dents or scratches which may indicate dropping or other damage.
   - All of the labels and markings on the ventilator are clear and legible.

Caution

Contact your clinician if the Achieva ventilator is damaged. Do not use a damaged ventilator.

NOTE:

A visual inspection should be performed each time the ventilator is used after storage as well as periodically during normal use.

2. If necessary, wipe down your ventilator with a mild soap solution.
3. Check to see if a clean air inlet filter is installed. If the filter is dirty, or if there is no filter in place, install a new one. See section 8.5.1, “Replacing the Air Inlet Filter,” on page 8-2.

4.2 Where to Place the Ventilator

Choose a place in your home to set up the ventilator according to the following safety guidelines:

Warning

- Ensure you can hear the ventilator's alarm from all rooms in the house, and when you are using appliances such as a vacuum cleaner, dishwasher, clothes dryer, television or radio. Do not leave the patient unattended if you cannot hear the ventilator's alarm.
- Do not place the ventilator in a position where a child could reach it and change the controls.
- Do not place the ventilator in any position that might cause it to fall on the patient.
- Place the ventilator where the patient circuit can easily reach the patient. Make sure the tubing hangs loose, without strain, so that the patient can move freely.
- Maintain at least four inches between the air inlet filter (on the back of the ventilator) and the wall. Make sure the rear panel is not close to draperies or other items that could block the air flow into the air inlet filter.
- Do not place anything in front of the ventilator's alarm port (on the side of the ventilator) that could block or decrease the sound of the alarm.
- Do not place anything in front of the ventilator's patient air port (on the front of the ventilator) that could block or decrease the amount of air flowing from the ventilator to the patient.

Caution

- Do not place the ventilator on or near electrical equipment such as a cellular or cordless phone, television, radio, microwave oven, or an electric heater. These may affect the ventilator and cause it to work improperly.
- Do not expose the ventilator to extreme moisture, such as direct exposure to rain. Extreme moisture can cause the ventilator to fail or work improperly.
- Do not place a humidifier above the ventilator. Moisture from the humidifier may condense in the patient circuit and may drain into the ventilator.
- Do not place a container of liquid on or near the ventilator. Liquids spilled on the ventilator may cause it to work improperly.

Follow these instructions to check your ability to hear the ventilator's alarm in the home.

1. Before connecting to the patient, place the ventilator on a flat, sturdy surface in the location where it will be used most frequently.
2. Plug the ventilator into a grounded AC power outlet, See section 4.5, "Connecting the Ventilator to an AC Power Outlet," on page 4-5.
3. Press the START/ENTER key to turn on the ventilator.
4. Press VENTILATE to start breath delivery. Because the ventilator is not connected to a patient, an alarm condition will sound.
5. Go to various parts of the home to make sure that you can hear the alarm. You should also turn on any device that produces sounds (for example: radio, television, tools, and household appliances) to ensure that you can still hear the ventilator alarm over each device.

   If you find that there are certain areas of the home or noisy activities over which you cannot hear the alarm, do not leave the patient alone while you are in those areas or engaging in those activities.

Remote Alarm Accessory

If required, a remote alarm accessory is available. The remote alarm can help you to hear the ventilator's alarm from a remote location. Contact your clinician or a Nellcor Puritan Bennett representative for more information on purchasing and using a remote alarm.

If you are using a remote alarm, follow the previous procedure to find the best location for it.

4.2.1 Electrical Interference

The Achieva ventilator may be subject to electrical interference. Electrical interference can come from television sets, cordless or cellular telephones, microwave ovens, air conditioners, food processors, and other appliances. Follow these guidelines to reduce the risk of interference:

- Do not place your ventilator near an appliance.
- Do not plug your ventilator into the electrical outlet or electrical outlet circuit that is used by an appliance.
- Do not place the ventilator cables near an appliance.

If your ventilator causes interference to other devices, follow the guidelines below:

- Turn the antenna on the affected device (for example: radio, television, cordless phone.)
- Move the device away from the ventilator.
- Connect the ventilator to an outlet which is on a different electrical circuit than the affected device.
- Consult the dealer or an experienced radio/TV technician for help.

4.3 Mounting the Ventilator on a Wheelchair

When using the ventilator on a wheelchair, follow these safety guidelines:

Warning

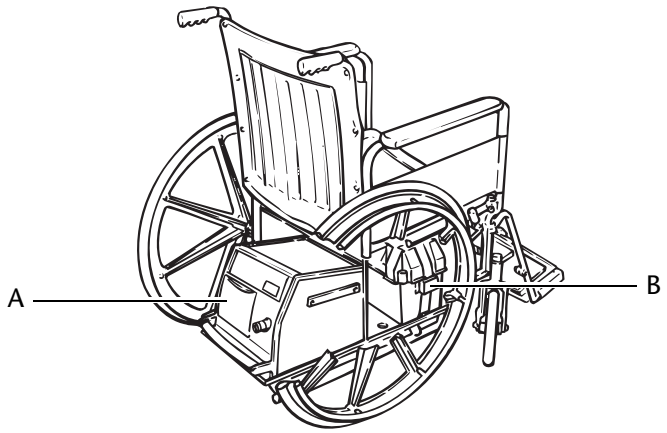
Position the external battery as far away from the ventilator's air inlet port as possible. This will help prevent battery gases from drifting toward the ventilator's air inlet.

Caution

- Always provide an external battery as the power source. Do not rely solely on the ventilator's internal battery to sustain ventilation.
- Do not use the same battery to power both the ventilator and an electric wheelchair.
- Protect the ventilator from extreme moisture, such as direct exposure to rain.
- Check the air inlet filter frequently while the ventilator is mounted on a wheelchair as environmental conditions may cause the air filter to become dirty more rapidly.

Mounting instructions may vary depending on the wheelchair model and manufacturer. Consult the wheelchair supplier or manufacturer for standard wheelchair adaptations. Figure 4-1 illustrates the recommended placement of the Achieva ventilator (item "A") and the external battery (item "B").

Figure 4-1. Ventilator and Battery Placement on Wheelchair



A. Achieva Ventilator
B. External Battery

It is a good idea to place a partition between the ventilator and the external battery. This will help to protect the ventilator from battery fluid, in the event of a battery leak. This partition should be at least four inches away from the ventilator's air inlet filter, so that it does not impede the flow of air into the ventilator.

If the ventilator and the battery are in the same tray, holes should be cut into the tray to allow any leaking battery fluid to drain away from the ventilator. Placing the battery in a plastic container may also help to protect the ventilator from leaking battery fluid.

4.4 Connecting the Patient Circuit

Connect the patient circuit (refer to Figure 3-6 on page 11) according to the circuit manufacturer's instructions. Ensure that all connectors fit snugly. If a connector does not fit properly, contact your clinician for guidance.

Caution

Do not use the ventilator if any of the connections do not fit properly.

4.5 Connecting the Ventilator to an AC Power Outlet

The ventilator may be operated indefinitely on AC power, or it can operate on its internal battery for a limited time. The ventilator may also be operated on an *external* battery for a limited time. If you are using an external battery, See section 4.6, “Using an External Battery,” on page 4-6.

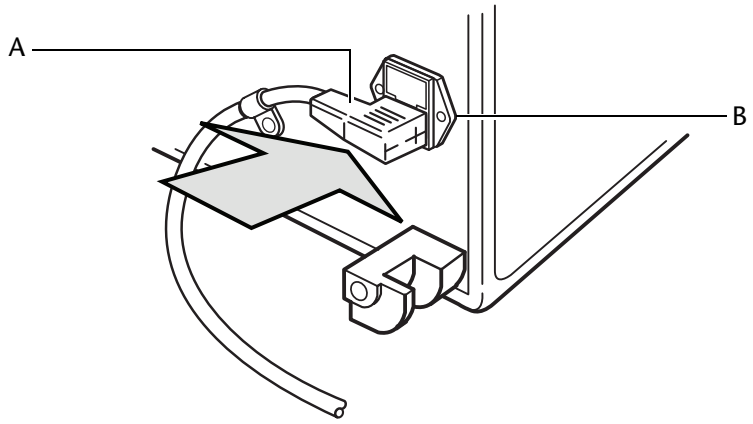
Warning

Do not plug the power cord into an electrical outlet controlled by a wall switch because the power may be accidentally turned off.

NOTE: Keep the ventilator plugged in to AC power whenever possible. This allows the ventilator to charge the internal battery.

1. Plug the socket end of the power cord (Figure 4-2, item “A”) into the power cord connector (Figure 4-2, item “B”) on the back of the ventilator.

Figure 4-2. Connecting the Power Cord to the Ventilator



A. Power Cord
B. Power Cord Connector

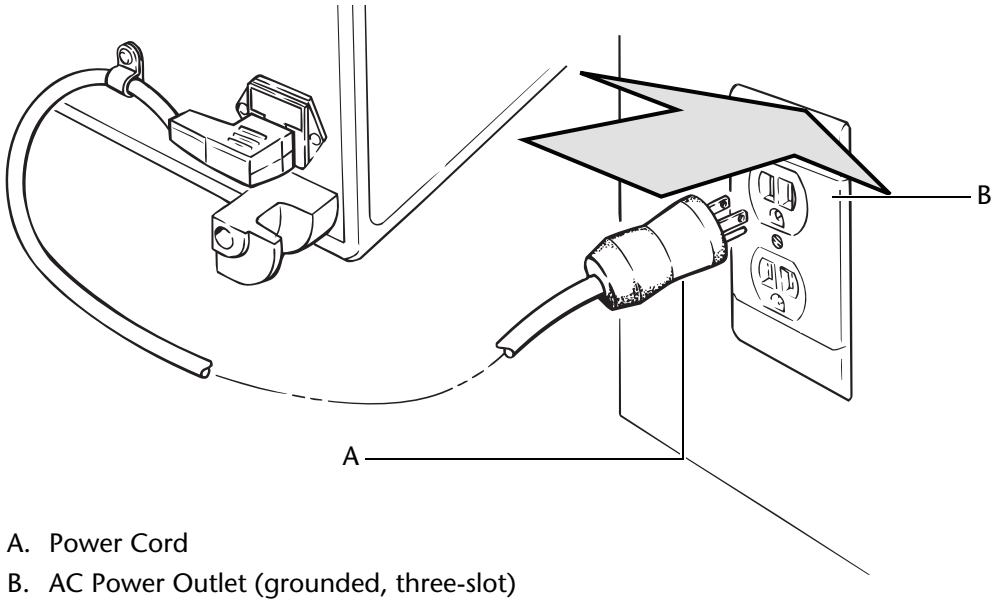
2. Plug the other end of the cord, the end with three prongs (Figure 4-3, item “A”), into an AC power outlet (Figure 4-3, item “B”). The outlet must be properly grounded - that is, it must have three slots. Contact your clinician or a qualified electrician if you do not have a suitable outlet.

When you plug in the ventilator, the BATTERY CHARGING and AC POWER indicators will light at the same time.

NOTE:

The power plug may not be compatible with outlets in some countries. If you encounter an outlet that is not compatible, contact your clinician for guidance. He or she will be able to recommend a suitable adaptor or replace your plug with one that is compatible with your outlets.

Figure 4-3. Connecting the Power Cord to an AC Outlet



A. Power Cord
B. AC Power Outlet (grounded, three-slot)

~AC 3. Verify that the BATTERY CHARGING and AC POWER indicators are lit.

Warning

If either the BATTERY CHARGING indicator or the AC POWER indicator does not light up, do not use the ventilator. Instead, call your clinician immediately.

4.6 Using an External Battery

When AC power is unavailable, the ventilator can operate from an external 12- or 24-volt DC battery.

NOTE:

For optimal performance, a 24-volt battery is recommended. Although a 12-volt battery can be used, a Setting Error alarm is more likely to occur as the 12-volt battery discharges.

Follow these safety guidelines when using an external battery:

Warning

- Position the external battery as far away from the ventilator's air inlet port as possible. This will help prevent battery gases from drifting toward the ventilator's air inlet.
- If the EXTERNAL BATTERY indicator does *not* light once the battery is connected, do *not* use the external battery. Instead, connect your ventilator to AC power and contact your clinician.

Caution

- Do not place a battery above or on top of the ventilator.
- Use only Puritan Bennett approved cables and batteries.

Follow the instructions included with your battery to connect it to your ventilator. Once the battery is connected, ensure that the ventilator's EXTERNAL BATTERY indicator is lit. This signals that your ventilator is properly connected and is using the external battery.

4.7 Setting the Low Pressure Alarm

The low pressure alarm will notify you if the air pressure in the patient circuit drops below a prescribed limit. Follow these safety guidelines when setting the low pressure alarm:

Warning

- Do not set the low pressure alarm while the ventilator is connected to the patient. Provide an alternate means of ventilation while setting the low pressure alarm.
- Under certain conditions, the patient's breathing effort may cause continuous low pressure alarms, even when the Low Pressure Alarm is carefully set. If this occurs, contact your clinician immediately for guidance.
- Repeat the low pressure alarm setting procedure whenever you change, replace, remove, or reconnect components of the patient circuit, or when you change the ventilator's parameters.
- If you are using an HME with your ventilator, you must periodically re-adjust the low pressure alarm setting. Contact your clinician to determine the appropriate re-adjustment interval.
- Some patient circuit components may inhibit low pressure alarms when the low pressure limit is not carefully set.

Follow these instructions for setting the low pressure alarm:

1. Ensure that the patient circuit is assembled exactly as it will be used by the patient. Attach all accessories, including the HME and inner cannula of the tracheostomy tube.
2. Verify that all of the ventilator's parameters are set to the prescribed values. Adjust them if necessary. See section 6.3, "Setting Parameters," on page 6-1.
3. Press VENTILATE to start breath delivery.
4. Press START/ENTER to display current settings.
5. Press LOW PRESSURE to select the low pressure parameter.
6. Press the UP ARROW or DOWN ARROW on the control panel to adjust the low pressure setting.
7. After each low pressure adjustment, allow the ventilator to complete two breath cycles. It takes two breath cycles for the alarm to sound.
8. If you do not hear the low pressure alarm (five audible pulses), repeat steps 6 and 7.
9. Stop adjusting the low pressure setting when you hear the low pressure alarm. The low pressure alarm is now set.

4.8 Configuring for Assist/Control Ventilation

Warning

- Risk of change from Assist/Control Volume ventilation mode to Assist/Control Pressure ventilation mode: If the ventilator is operating in Assist/Control Volume ventilation and the MODE key is pressed, the setting display will show "Assist/Control Pressure" using the last pressure support value setting (such as the Pressure Support value set for SIMV or SPONT.) If the START/ENTER key is pressed while this Assist/Control Pressure display is present, the ventilator will switch to operating in Assist/Control Pressure ventilation mode. Therefore, do NOT press START/ENTER *unless* you intend to *change* to Assist/Control Pressure ventilation mode and you have *verified* that the ventilator is set to the *correct* pressure.
- To eliminate the possibility of an accidental change in ventilator parameters by an inadvertent START/ENTER entry, set the Pressure Support mode values to zero ("0") before placing the ventilator into the Assist/Control Volume ventilation mode. Follow the instructions below.

Set the Pressure Support Values to Zero

Performing his procedure eliminates the possibility of an accidental change in ventilator parameters.

MODE 1. Press MODE.

▽ △ 2. Press the UP ARROW or the DOWN ARROW key to scroll to the SPONT mode. (10 BPM back-up rate will be displayed.)

↵ 3. Press START/ENTER.

▽ △ 4. If Pressure Support is present, press the UP ARROW and the DOWN ARROW keys to set the value to zero ("0").

↵ 5. Press START/ENTER to accept the setting.

MODE 6. Press MODE.

▽ △ 7. Press the UP ARROW and the DOWN ARROW keys to scroll to the SIMV mode.

↵ 8. Press START/ENTER.

▽ △ 9. If Pressure Support is present, press the UP ARROW and the DOWN ARROW keys to set the value to zero ("0").

↵ 10. Press START/ENTER to accept the setting.

MODE 11. Press MODE.

▽ △ 12. Press the UP ARROW and the DOWN ARROW keys to scroll to the A/C mode.

↵ 13. Press START/ENTER.

▽ △ 14. If a pressure value is present, press the UP ARROW and the DOWN ARROW keys to set the pressure to zero ("0")

↵ 15. Press START/ENTER.

CHAPTER 5

Test

5.1 Completing the User Self Test

Before connecting the patient, it is important to test your ventilator to make sure that it is working properly. It is recommended that the User Self Test be conducted:

- Before initial use
- Once per month
- Each time you remove or replace the patient circuit

Warning

- Do not conduct this test while the patient is connected to the ventilator. Switch the patient to an alternate means of ventilation before conducting this test.
- To reduce the risk of infection, be sure to wash your hands thoroughly before and after handling the ventilator or its accessories.

NOTE:
Nellcor Puritan Bennett recommends that you run the User Self Test before initial use, once per month while the ventilator is in use, and each time you remove or replace the patient circuit. Nellcor Puritan Bennett recognizes that the protocol for running the User Self Test varies widely among health care providers. It is not possible for Nellcor Puritan Bennett to specify or require specific practices that will meet all needs, or to be responsible for the effectiveness of those practices.

⏻ 1. Press and hold the STANDBY key for three (3) seconds. The ventilator will switch to Standby mode and will stop delivering air.

MENU/ESC 2. Press the MENU/ESC key. The following text will appear in the display:

Press ENTER to begin User Self Test.

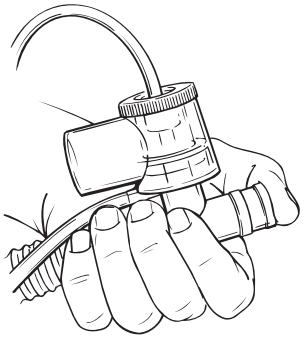
↵ 3. Press the START/ENTER key. The following text will appear in the display:

Occlude patient end of breathing circuit.

4. Block the part of the exhalation manifold that connects to the patient, as illustrated in Figure 5-1. Make sure that you have a tight seal and do not let any air escape. The following message will be displayed:

Press ENTER when ready to begin test.

Figure 5-1. Blocking the Exhalation Manifold



5. Keep your seal on the exhalation manifold and press the START/ENTER key. The ventilator will push air into the circuit as it runs the test.

   Once the test is completed, you will see one of four messages in the LCD window. Refer to Table 5-2 for a listing of the display messages and appropriate responses.

Table 5-2: User Self Test Results

If the ventilator displays...	It Means...	Do this...
TEST PASSED. ENTER: repeat ESC: exit	The ventilator passed the User Self Test.	• Press START/ENTER if you wish to repeat the test. • Press MENU/ESC to end the test. The ventilator will switch to Standby mode.
Test ERROR. Refer to MANUAL.	The test was not conducted properly.	• Press ALARM SILENCE/RESET to cancel the test. The display will indicate that the test failed. • Check all connections in the patient circuit. Press START/ENTER to repeat the test.
Leak Test FAILED. Refer to MANUAL	There is a leak in the patient circuit between the patient air port and the exhalation manifold.	• Press ALARM SILENCE/RESET to cancel the test. The display will indicate that the test failed. • Press START/ENTER to repeat the test. • If the ventilator fails the test again, connect a new patient circuit and retry. • If the ventilator fails after connecting a new patient circuit, contact your clinician.
Relief Valve Test FAILED. Refer to MANUAL	The ventilator's relief valve is not functioning properly.	• Press ALARM SILENCE/RESET to cancel the test. The display will indicate that the test failed. • Press START/ENTER to repeat the test. • If the ventilator fails the test again, contact your clinician.

Warning

If the ventilator fails the User Self Test, do not use it; instead, contact your clinician.

5.2 Testing the Ventilator's Alarms

Before connecting to the patient, conduct the following tests to ensure the ventilator's alarm functions are working properly.

Warning

- Do not attempt to conduct ventilator alarm tests while the patient is connected to the ventilator. Provide an alternate means of ventilation during testing.
- If the ventilator fails the alarm test or if you cannot complete the test, refer to the Troubleshooting chapter of this manual or call your clinician, the equipment supplier, or Puritan Bennett technical support.

↵ While the ventilator is in Standby mode, press the START/ENTER key to check the ventilator's settings. The initial settings for these tests are:

Breath Rate:	12 BPM (breaths per minute)
High Pressure:	80 cm H_2O
Low Pressure:	3 cm H_2O
Volume:	500 ml
Inspiratory Time:	1.0 seconds
FIO_2:	21 percent
Ventilation Mode:	Assist/Control

Before proceeding with the alarm tests, ensure that the ventilator settings match those shown above.

NOTE:

Unless otherwise stated, set the ventilator to Standby mode before beginning each of the following tests.

Most of these tests require that an approved patient circuit be connected to the ventilator. Ensure that your patient circuit is properly connected prior to conducting these tests.

5.2.1 Low Pressure Test

1. Adjust the ventilator settings to the following values:
   - Volume: 500 ml
   - Inspiratory Time: 0.4 seconds
   - Low Pressure Alarm: 5 cm H_2O
2. Keeping the patient end of the breathing circuit open, allow the ventilator to deliver three (3) consecutive breaths. At the beginning of the inspiration of the third breath, verify that the following events occur:
   - LED for the low pressure alarm is lit

- LCD display indicates that a Low Pressure Alarm has occurred
- Audible alarm sounds

3. Press and hold the STANDBY key for three (3) seconds. The ventilator will switch to Standby mode.
4. Press the ALARM SILENCE/RESET key to reset the alarm.

5.2.2 Apnoea Test

1. Adjust the ventilator settings to the following values:
   - Volume: 500 ml
   - Inspiratory Time: 0.5 seconds
   - Breath Rate: BPM
2. Press and hold the VENTILATE key for one (1) second to begin ventilation. The ventilator will deliver a mandatory breath.
3. Before the second mandatory breath is delivered, verify that:
   - the LED for the low pressure alarm is lit
   - the LCD display indicates that an Apnoea Alarm has occurred
   - the audible alarm sounds
4. Press and hold the STANDBY key for three (3) seconds. The ventilator will switch to Standby mode.
5. Press the ALARM SILENCE/RESET key to reset the alarm.

5.2.3 Power Failure Test

NOTE:
If the ventilator is operating on either the external or internal battery, you must plug the ventilator into an AC power source before beginning this test.

1. Press and hold the VENTILATE key to begin ventilation.
2. Unplug the ventilator and verify the following:
   - the POWER SWITCH-OVER LED turns on
   - the LCD display indicates that the AC power source is *not* powering the ventilator
   - the LED power-source indicator also indicates that the ventilator is *not* receiving AC power
   - the audible alarm sounds
3. Press and *hold* the STANDBY key for three (3) seconds. The ventilator will switch to Standby mode.
4. Press the ALARM SILENCE/RESET key to reset the alarm.

5.2.4 Continuing Pressure (Valley) Test

1. Adjust the ventilator settings as follows:
   - Volume setting: 200 ml
   - Inspiratory Time: 0.5 seconds
2. Connect the patient end of the patient circuit to a 1-liter elastic bag. Verify that the pressure tube of the patient circuit is properly connected to the appropriate fitting on both the ventilator and the proximal pressure port.
3. Block the exhalation port of the breathing circuit's exhalation valve. See Figure 5-1 on page 5-2.
4. Press and hold the VENTILATE key for one (1) second to begin ventilation.
5. Allow the ventilator to deliver four (4) consecutive breaths. At the beginning of the fourth breath, verify the following:
   - the LED for the Low Pressure Alarm is lit
   - the LCD display indicates that a Valley Alarm has occurred
   - the audible alarm sounds
6. Unblock the exhalation port.
7. Press and hold the STANDBY key for three (3) seconds to switch the ventilator to Standby mode.
8. Press ALARM SILENCE/RESET to reset the alarm.

5.2.5 High Pressure Test

1. Adjust the ventilator settings as follows:
   - Volume: 500 ml
   - Inspiratory Time: 0.4 seconds
   - Low Pressure Alarm: 50 cm H_2O
2. Press and hold the VENTILATE key for one (1) second to begin ventilation.
3. Keeping the patient end of the breathing circuit open, allow the ventilator to deliver one (1) breath.
4. During the inspiratory phase of the next breath, block the patient end of the breathing circuit. Verify the following:
   - the LED for the high pressure alarm is lit
   - the LCD display indicates that a High Pressure Alarm has occurred
   - the audible alarm sounds
5. Unblock the exhalation port.
6. Press and hold the STANDBY key for three (3) seconds to switch the ventilator to Standby mode.
7. Press ALARM SILENCE/RESET to reset the alarm.

5.3 Testing the Battery

The ventilator is capable of testing the power of the battery it is currently using. You can determine which power source the ventilator is using by checking the power indicator, located on the top panel (Figure 3-2 on page 5). The indicator lights to indicate which power source is currently being used.

NOTE:
The TEST BATTERY key does not operate when the ventilator is powered by AC.

TEST To test the battery, press and hold the TEST BATTERY key. The needle on the PATIENT PRESSURE meter will indicate the battery charge status for the battery it is currently using.

A fully charged battery, in good condition, will register approximately 100% on the patient pressure meter's scale.

5.4 Monthly Safety Check

You should perform the following safety check *before* using the ventilator with the patient, and once every month while the ventilator is in use (but not connected to the patient) to ensure that the ventilator is operating properly. This safety check takes approximately ten minutes to complete.

Warning

- Do not conduct this test while the patient is connected to the ventilator. Use an alternate means of ventilation while you are conducting this test.
- If the ventilator fails the monthly safety check or if you cannot complete this check, refer to the *Troubleshooting* chapter of this manual or call your clinician, the equipment supplier, or Nellcor Puritan Bennett technical support.
- To reduce the risk of infection, wash your hands thoroughly before and after handling the ventilator or its accessories.

NOTE:
Nellcor Puritan Bennett recommends that you run the Monthly Safety Check once per month while the ventilator is in use. Nellcor Puritan Bennett recognizes that the protocol for running the Monthly Safety Check varies widely among health care providers. It is not possible for Nellcor Puritan Bennett to specify or require specific practices that will meet all needs, or to be responsible for the effectiveness of those practices.

1. **Visual Inspection**

   Inspect the device to ensure that:

   – The power cord does not have any kinks, breaks or damaged insulation.

   – The connectors, rubber feet, filter housings, etc. are not loose or broken.

   – The outer casing does not have any dents or scratches which may indicate dropping or other damage.

   – All of the labels and markings on the ventilator are clear and legible.

2. **User Self Test**

   See section 5.1, "Completing the User Self Test," on page 5-1.

3. General Alarm Test

Press and hold the ALARM SILENCE/RESET key for five (5) seconds. You should see all of the alarm indicators light up and hear an alarm tone. If not, the ventilator is in need of repair. Do not use the ventilator until the ventilator has been repaired.

4. High/Low Pressure Alarm Test

a. Set the ventilator mode to ASSIST/CONTROL (A/C). Press VENTILATE.

b. Block the patient end of the patient circuit. It is important that you make a tight seal and do not let any air escape. This will force the air pressure to build up in the patient circuit, causing a high pressure alarm.
At the next breath, the ventilator should sound a high pressure alarm. You will hear three (3) pulses of the alarm tone and will see the HIGH PRESSURE indicator flash.

c. Unblock the end of the patient circuit. Press ALARM SILENCE/RESET to reset the high pressure alarm.

d. Allow the ventilator to complete two to three (2 – 3) breath cycles. A low pressure alarm should occur. You will hear five (5) pulses of the alarm tone and see the LOW PRESSURE indicator flash.

e. Press ALARM SILENCE/RESET to reset the low pressure.

f. Press and hold STANDBY for three (3) seconds to put the ventilator in Standby mode.

This concludes the monthly safety check.

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CHAPTER 6

Operation

6.1 Turning on the Ventilator

Open the front door panel. Press the START/ENTER key. You will see the current parameters displayed in the LCD window. The ventilator will be in Standby mode.

Check the parameters to make sure they agree with the prescribed settings. If the parameters are incorrectly set, you should adjust them at this time. See "6.3 Setting Parameters", below.

6.2 Displaying Settings

While the ventilator is in Standby Mode—that is, while it is not ventilating—you can display settings by pressing START/ENTER.

While the ventilator is ventilating, the LCD window will display the actual values of the breaths being delivered. To check the settings during ventilation, press START/ENTER. The setting values will be displayed in the LCD window for approximately four to five (4 – 5) breath cycles. After this interval, the LCD window will revert to displaying actual patient values.

NOTE:

Certain settings, such as low pressure and high pressure alarm settings, do not have an actual value and dashes (---) are displayed instead.

6.3 Setting Parameters

Warning

- Never press the START/ENTER key without verifying that the ventilator's parameters are set appropriately. Using incorrect settings during ventilation can endanger the patient.
- Your clinician will prescribe specific parameter settings for your patient. Always follow your clinician's instructions when setting the ventilator's parameters.

1. Open the front door panel. Press the START/ENTER key to display the current settings.
2. Press the parameter key for the setting you wish to change. The current setting for that parameter will begin to flash in the LCD window.
3. Use the UP ARROW or DOWN ARROW key to adjust the setting's value.
4. When the parameter's value matches the prescribed value, press START/ENTER to accept the prescribed setting.

6.4 Starting Ventilation

Warning

You must start the ventilator and allow it to complete one full breath cycle prior to connecting the patient. Do not connect the patient before this cycle completes.

NOTE:

If you are powering the ventilator with the external battery or the ventilator's internal battery, the ventilator will require a warm-up period of approximately seven (7) seconds before starting ventilation. You must wait until the ventilator's LCD window displays the settings, which indicates the ventilator is ready. Pressing VENTILATE prior to the completion of this warm-up period will cause the ventilator to power down.

1. Press VENTILATE to start ventilation. You will hear the ventilator's piston begin to move.

   As ventilation begins, ensure the following:

   - The indicators on the ventilator's display are lit and the alarm sounds. If these events do not occur, the ventilator needs repair. Do *not* use the ventilator; instead, contact your clinician for assistance.
   - The pressure trigger and altitude settings agree with the prescribed settings.

Allow the ventilator to complete one full breath cycle before connecting the patient. This cycle establishes the ventilator's reference point and is important for proper breath delivery. Each time you hear the ventilator's piston begin to move, it is the beginning of a breath cycle. When the piston becomes silent, it is the end of a breath cycle.

6.5 Stopping Ventilation

1. Disconnect the ventilator from the patient.
2. Put the ventilator in Standby mode: Press and hold the STANDBY key for at least three (3) seconds.
   - You will hear a beep and ventilation will stop.
   - The following text will appear in the display:

     STANDBY: Press START/ENTER to view parameters

NOTE:

The ventilator can be kept in Standby mode indefinitely while connected to AC power. While in this mode, the ventilator charges the internal battery and the power indicators (AC and Battery Charging) are lit. When powered from a battery, the ventilator will remain in Standby mode for 30 seconds and then switch automatically to a low-power mode. Press the START/ENTER key to exit low power mode.

CHAPTER 7

Alarms and Alerts

Alarms let you know when a condition exists that endangers the patient and requires your immediate attention; they are accompanied by an audible tone.

Alerts let you know when a condition exists that is not a direct risk to the patient, but still requires your attention. The ventilator does *not* sound an audible tone during an alert condition.

This chapter of the manual describes what you will see and hear and steps you should take during an alarm or alert. It also describes how you can use the ventilator's alarm related controls to:

- Adjust the alarm limits for your patient
- Adjust the latching mode of the ventilator's alarms

Warning

- If an alarm occurs, attend to the patient first. Switch to an alternate means of ventilation if necessary.
- This manual tells you how to respond to the ventilator when an alarm occurs. It does NOT tell you how to respond to the patient when an alarm occurs. Your clinician will tell you how to respond to the patient in an alarm condition.
- Any device is subject to unpredictable failures. To ensure patient safety, an appropriately trained caregiver should monitor ventilation.
- If the patient's condition warrants the use of an independent secondary alarm or other external monitoring device, the clinician should prescribe such an alarm or device. The clinician should also determine the patient's need for an alternate means of ventilation in the event of ventilator failure.

7.1 Alarm/Alert Conditions

Table 7-1 lists the alarm or alert conditions that may occur, describes what you will see and hear, and provides you with general instructions for addressing these alarms. For detailed technical information about the different alarms and alerts, see section "9.3 Alarm Conditions" on page 9-6.

Table 7-1: Alarm and Alert Conditions

If you Hear...	And See...	It means...	Do This:
Repeating burst of 5 alarm pulses	Flashing LOW PRESSURE/ APNOEA indicator:	The pressure in the patient circuit has dropped below the Low Pressure setting.	1. Attend to the patient first, as instructed by your clinician. If the patient is not in danger, continue to step 2. 2. Check the patient circuit for kinks or loose connections. Fix or replace the patient circuit if necessary. 3. Inspect for and remove water from small tubing. 4. Check the ventilator's settings. Verify that the ventilator settings are set according to the prescription. 5. If the alarm condition persists, discontinue use of the ventilator and contact your clinician for guidance.
	Flashing SETTING ERROR indicator:	The ventilator has detected an equipment failure.	1. Attend to the patient first, as instructed by your clinician. 2. Switch to an alternate means of ventilation. 3. Press the STANDBY key ⏻. If this corrects the error, resume normal ventilation. If not, proceed to step 4. 4. Unplug the ventilator from AC power and wait 30 seconds. Plug the ventilator into AC power and resume ventilation. If the alarm has not cleared, proceed to step 5. 5. Unplug the ventilator from AC power; then, press and hold STANDBY ⏻ for three (3) or more seconds. Plug the ventilator into AC power and resume ventilation. If the alarm has not cleared, contact your clinician.
	Flashing LOW POWER indicator:	The internal battery charge is depleted	1. Disconnect the ventilator from the patient 2. Press and hold the STANDBY key ⏻ for three (3) seconds. 3. Connect the ventilator to an external power supply. If using AC power, the internal battery will automatically begin to charge. 4. Press VENTILATE to resume ventilation. 5. If using a charged external battery: you must press START/ENTER ↵ to restart; then, wait seven (7) seconds and press VENTILATE to begin charging the battery and resume ventilation. 6. Operate the ventilator on AC power for at *least* four (4) hours to recharge the internal battery.

Table 7-1: Alarm and Alert Conditions (continued)

If you Hear...	And See...	It means...	Do This:
Repeating burst of 3 pulses	Flashing LOW POWER indicator	The internal battery charge is extremely low (approximately 10 minutes of power remaining.)	1. Immediately connect the ventilator to an adequate power supply. 2. Operate the ventilator on AC power for at least four (4) hours to recharge the internal battery.
	Flashing HIGH PRESSURE indicator	The pressure in the patient circuit is higher than the High Pressure setting.	1. Attend to the patient first, as instructed by your clinician. 2. Check the patient circuit for kinks or obstructions. Fix or replace the patient circuit if necessary. 3. Check the ventilator's settings and verify they are set according to the clinician's prescription. 4. If the alarm condition persists, discontinue use of the ventilator and contact the clinician for guidance.
	Flashing O_2 FAIL indicator	The O_2 source or the ventilator's oxygen blender has failed. (Achieva PSO_2 only)	1. Attend to the patient first, as instructed by your clinician. 2. Supply another oxygen source. Monitor the delivered oxygen. 3. If the alarm condition persists, discontinue use of the ventilator and contact your clinician for guidance.
Single beep, repeated every 5 minutes	Flashing SETTING ERROR indicator	There is a conflict with one or more of the setting values.	1. Attend to the patient first, as instructed by your clinician. 2. Check the ventilator's settings and verify they are set according to the clinician's prescription. 3. If the alarm condition persists, discontinue use of the ventilator and contact your clinician for guidance.
	Flashing LOW POWER indicator	The internal battery charge is low (approximately 45 minutes of power remaining.)	1. Immediately connect the ventilator to an adequate power supply. 2. Operate the ventilator on AC power for at least four (4) hours to recharge the internal battery.
Single beep, repeated every 30 minutes	Flashing SETTING ERROR indicator	The ventilator has detected an equipment failure (minor fault condition.)	1. Attend to the patient first, as instructed by your clinician. 2. Check the patient circuit and accessory equipment. Make sure that all equipment is in good condition and properly connected. Replace if necessary. 3. If the ventilator will not start ventilation, continues alarming at the current rate, or the rate of the alarm's beeping increases, discontinue use of the ventilator and contact your clinician for guidance.
Single beep, repeated every 15 minutes	Flashing SETTING ERROR indicator	The ventilator has detected an equipment failure (serious fault condition) during ventilation.	

Table 7-1: Alarm and Alert Conditions (continued)

If you Hear...	And See...	It means...	Do This:
Single 3-second tone	Flashing SETTING ERROR indicator ?	The ventilator has detected a serious fault condition while in Standby mode. The ventilator is not ventilating.	1. Attend to the patient first, as instructed by your clinician. 2. Check the patient circuit and accessory equipment. Make sure that all equipment is in good condition and properly connected. Replace if necessary. 3. If the ventilator will not start ventilation, continues alarming at the current rate, or the rate of the alarm's beeping increases, discontinue use of the ventilator and contact your clinician for guidance.
Steady alarm tone	N/A	The ventilator has detected a micro-processor error.	1. Attend to the patient first, as instructed by your clinician. 2. Contact your clinician. Do not use the ventilator. Provide a backup means of ventilation.
Repeated single beep	Flashing POWER SWITCHOVER indicator ~AC⇒	The ventilator has switched to another power source.	1. Acknowledge the power switchover by pressing ALARM SILENCE/RESET 60s. 2. If the ventilator has switched to its internal battery, monitor ventilation or provide an alternate power source as soon as possible.
None	Flashing SETTING ERROR indicator ?	The ventilator has detected an error with either the volume or inspiratory settings. (Alert status.)	1. Attend to the patient first, as instructed by your clinician. 2. Check the ventilator's settings. Verify that the ventilator settings are set according to the prescription. 3. If the alert condition persists, discontinue use of the ventilator and contact your clinician for guidance.

7.2 Resetting Alarms

60s After you have corrected the alarm condition, press ALARM SILENCE/RESET to reset the alarms and deactivate the indicators on the Alarms panel.

7.3 Alarm Latching

Some of the ventilator's low pressure alarms can operate in either a latching or non-latching mode.

60s • A non-latching alarm does *not* require you to press ALARM SILENCE/RESET to stop the audible alarm when the condition has been corrected. It will automatically turn off the audible alarm, but the visual indicator on the Alarms panel will still light. This lets you know that an alarm event occurred and was corrected.

60s • A latching alarm will *not* stop the audible alarm unless the condition has been corrected *and* the ALARM SILENCE/RESET key has been pressed. Pressing the ALARM SILENCE/RESET key lets the ventilator know that you have responded to the alarm.

To set the latching mode of the alarms:

MENU/ESC 1. Press MENU/ESC.

▽ △ 2. Press the UP ARROW or DOWN ARROW keys until the display screen reads:

PRESS START/ENTER TO CHANGE ALARM LATCHING STATUS.

3. Press START/ENTER. The display will indicate the alarm's latching mode and will provide further instructions.

4. Follow the displayed instructions to change the alarm's latching mode.

5. After making your change:

   - Press START/ENTER to save, or
   - Press MENU/ESC to exit without saving.

NOTE:
If you exit *without* saving, changes to the alarm latching mode will *not* be saved.

7.4 Pre-Silencing Audible Alarms

There may be situations in which you wish to silence an anticipated alarm for a brief period. The ventilator allows you to "pre-silence" audible alarms for up to sixty seconds.

To pre-silence audible alarms, press ALARM SILENCE/RESET. This will silence any audible alarms for up to sixty seconds. During this period, the indicators on the alarm display panel will *still* light to indicate an alarm condition, but the alarm will *not* sound.

To stop pre-silencing of audible alarms, press ALARM SILENCE/RESET.

NOTE:
If an alarm condition occurs and is corrected during the pre-silence period, pressing ALARM SILENCE/RESET will reset the alarms and deactivate the indicators.

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CHAPTER 8

Cleaning and Maintenance

This chapter contains instructions for cleaning and maintaining your Achieva ventilator. Refer to the manufacturer's instructions for details on cleaning your ventilator's accessories.

Warning

To reduce the risk of infection, wash your hands thoroughly before and after cleaning or handling the ventilator or its accessories.

8.1 Cleaning the Ventilator

Warning

Do not spray, pour, or spill any liquid on the ventilator, its accessories, connectors, switches, or case openings.

Caution

- Do not use chemical agents (such as alcohol, MEK, trichloroethylene, or ethylene oxide) or steam to clean the ventilator. Use of chemical agents or steam may damage the ventilator.
- Keep the front panel door closed while cleaning your ventilator.

Follow these instructions for cleaning the surface of your ventilator:

1. Dip a clean, soft cloth into a mixture of mild soap and water.
2. Squeeze the cloth thoroughly to remove excess liquid.
3. Wipe the ventilator's external case, taking care to avoid allowing excess moisture to enter the openings on the ventilator's surface.
4. Dry the ventilator's surface with a clean, soft cloth.

8.2 Cleaning the Accessories

Follow your accessory manufacturer's instructions for cleaning your ventilator's accessories.

8.3 Recharging the Internal Battery

Caution

Recharge the ventilator's internal battery after each use.

While connected to AC power in any mode (including Standby), the ventilator automatically recharges its internal battery.

If you are using the *external* battery to power the ventilator, the internal battery will be charged only while the ventilator is ventilating. The battery will not be charged while the ventilator is in Standby mode.

NOTE:

Charging the ventilator's internal battery from the external battery will reduce the amount of charge left in the external battery.

8.4 Cycling Internal and External Batteries

Every four to six weeks, the ventilator's batteries need to be fully discharged then recharged to optimize battery performance. Follow the instructions below.

8.4.1 External Battery

Use the external battery to power the ventilator until it switches to the internal battery (which signals that the external battery's charge is depleted.) Immediately disconnect the external battery and connect the ventilator to an AC power source. Follow the battery manufacturer's instructions for recharging the external battery.

8.4.2 Internal Battery

Use the internal battery to power the ventilator until the low power alarm sounds. Immediately connect the ventilator to AC power to begin recharging the battery. Keep the ventilator connected to AC power and allow the internal battery to charge for at least twelve (12) hours.

8.5 Home Maintenance

8.5.1 Replacing the Air Inlet Filter

The ventilator uses the model Y-1609 Inlet Filter (Flatpak) to filter the air that is delivered to the patient. Inspect the filter regularly. If any discoloration is present, replace the filter as described below.

Caution

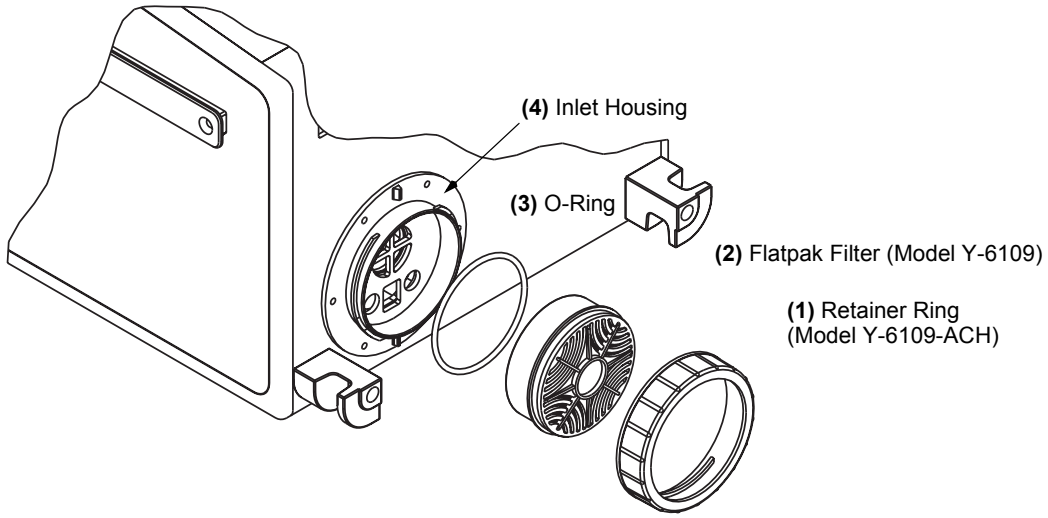
- Failing to change a dirty filter, or operating the ventilator without a filter in place, can cause serious damage to the ventilator.
- The air inlet filter is not reusable; do not attempt to wash, clean, or reuse it.

If the ventilator is used indoors, the air inlet filter should be checked monthly. If the ventilator is used outdoors, in transport, or in a dusty atmosphere, check the filter *weekly* and replace as necessary.

When performing the following steps, refer to Figure 8-1.

1. Twist off the retainer ring (item 1) from the inlet housing (item 4) on the back panel of the ventilator.
2. Replace the old air inlet filter cartridge (item 2) with the new cartridge. Discard the old cartridge.
3. Re-assemble the O-ring (item 3), filter (item 2) and retainer ring (item 1) as shown.
4. Twist the retainer ring (item 1) to secure it, taking care not to overtighten it.

Figure 8-1. Air Inlet Filter Assembly



8.5.2 Changing the Ventilator's Fuses

If the ventilator is plugged into an AC outlet, but the BATTERY CHARGING LED is *not* lit, a fuse may need to be replaced. The fuses for the ventilator are rated at 250 V, 3.15 A, 5 x 20 mm, slow blow.

Warning

To reduce the risk of electrical shock, disconnect the ventilator from AC power before attempting to change any fuses.

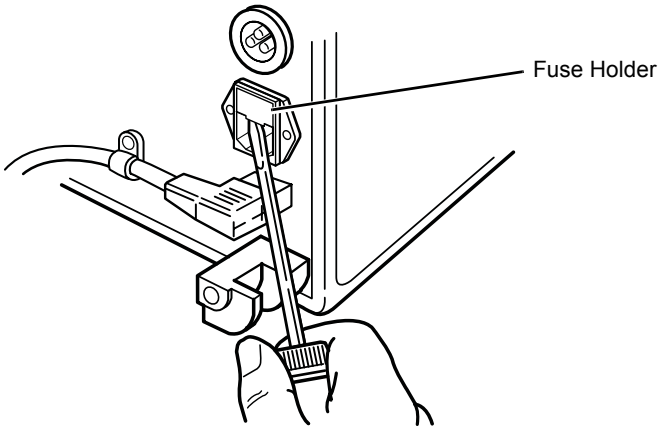
Caution

To prevent a fire hazard, replace fuses with identically rated fuses only.

To replace the ventilator's fuses, perform the steps below. Refer to Figure 8-2.

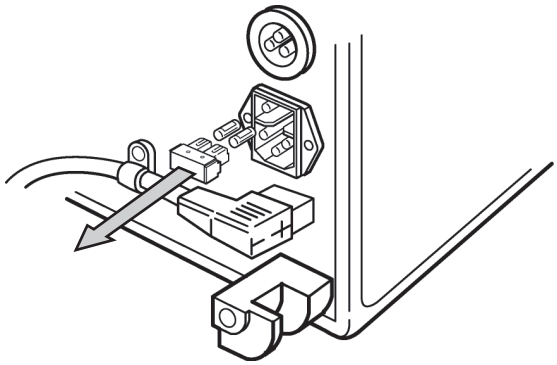
1. Unplug the ventilator from the AC power outlet.

Figure 8-2. Removing the Fuse Holder



2. Insert a small screwdriver under the tab on the bottom of the fuse holder.
3. Pull the screwdriver upward and outward until the fuse holder pops out slightly.
4. Pull the fuse holder out (Figure 8-3).
5. Remove the old fuses from the fuse holder.

Figure 8-3. Fuse Assembly



6. Place the new fuses into the fuse holder.
7. Return the fuse holder to its original position and press it into place. You should hear a "click" that indicates the fuse holder is securely positioned.
8. Reconnect the ventilator's AC power cord to the AC power outlet.

8.6 Preventive Maintenance

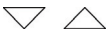
Preventive Maintenance must be performed by qualified personnel every 6000 operating hours, or recertification every twelve (12) months—whichever occurs first.

Warning

Do not try to repair or otherwise service the ventilator yourself. Doing so might endanger the patient, cause damage to the ventilator, and/or void your warranty.

Check to see the time elapsed since maintenance was last performed as follows:

MENU/ESC 1. Press the MENU/ESC key.

 2. Press the UP ARROW or the DOWN ARROW key until the display screen says:

Ventilating hours since last maintenance: XXXXX.

(Where "XXXXX" is the total number of operating hours.)

When the ventilator's total number of operating hours nears 6000, schedule a service appointment with a trained service representative.

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CHAPTER 9

Technical Reference

9.1 Introduction

This chapter is intended for the clinician who is assisting the user in the homecare environment.

9.2 Ventilator Specifications

Power	
Power Line	100 to 240 VAC, 50 to 60 Hz, 2 Amps
External DC Power	11.6 to 32.0 VDC (24 VDC optimal)
	Operating time: At least 19 hours under *normal* load, and 5 hours 30 minutes under *heavy* load. 24 VDC (or 12 VDC, 32 Ah)*
Internal Battery	24 VDC (nominal)
	Operating time: At least 4 hours under *normal* load, and 1 hour under *heavy* load*
	Gel cell, sealed Lead Acid, backup power
	Lithium Battery (memory power)
Standard Power Converters	90 to 200 VAC
Fuses	250 V, 3.15 A, 5 X 20 mm, slow blow
Power Usage	
Maximum	Absolute maximum is 75 W
Minimum	10 W
Type	Positive Pressure Volume ventilator
Motor	3-Phase Brushless Motor
Pump	Piston, 50 ml to 2200 ml tidal volume capability
Protection against electrical shock	Type of protection: Class I Degree of protection: Type BF

*Normal Load: Mode = Assist/Control, Volume = 1000 ml, Breath Rate = 10 BPM, Inspiratory Time = 1.5 sec., F_IO_2 = 21%, Sensitivity = 5 LPM, PEEP = 0 cmH_2O/hPa, Vent pres. = 30 cmH_2O/hPa
Heavy Load: Mode = Assist/Control, Volume = 1500 ml, Breath Rate = 20 BPM, Inspiratory Time = 1.0 sec., F_IO_2 = 100%, Sensitivity = 5 LPM, PEEP = 20 cmH_2O/hPa, Vent pres. = 60 cmH_2O/hPa

Indicators	
Normal Events	
Patient Pressure Meter	Displays patient pressure, -10 to + 100 cmH_2O/hPa; also displays battery charge when the TEST BATTERY key TEST is pressed.
Alphanumeric Display	Shows current operating parameters and ventilator information.
Power ~AC 	Green LEDs indicate operating power source: • AC • External Battery • Internal Battery
Battery Charging	Green LED indicates the unit is charging the internal battery.
Assist/Spontaneous	Green LED indicates that the patient's effort exceeds the sensitivity setting.
Alarm Control	Red LED flashes at 1-second intervals during a presilence condition and continuously when the non-latching alarm feature is active.
Alarms P↓ P↑ ? ~AC⇒ 	Flashing red LEDs: • Low Pressure/Apnoea • Low Power • High Pressure • Setting Error • Power Switch-Over • O_2 Fail (O_2 Fail available only on Achieva PSO_2)
Audible Alarms	
One Second Beep	Relief Valve Test Failure, User Self Test Error, Leak Test Failure.
Repeated Single Beep	Power Switch-Over.
Repeated Three Pulses	Extremely Low Internal Battery, High Pressure, Invalid I:E Ratio, High Pres<Low Pres, Volume Error, Rate Error, Inspiratory Error, Oxygen Alarm, Pressure Differential Error.
Repeated Five Pulses	Low Pressure, Valley, Exhale Fail, Apnoea, Battery Charge Depleted, Vent Inop.
Continuous Tone	Microprocessor failure.
Single Beep Every Five Minutes	Low internal battery.
One Second Beep Every Thirty Minutes	Minor Fault.
One Beep Every Fifteen Minutes	Ventilator is ventilating and serious fault is detected.
Three Second Tone	Ventilator is in standby mode and a serious fault is detected.
Alarm Volume	85 db or 70 db at a distance of 1 meter.

Controls	
Alarm Silence/Reset 60S	1. Silences audible alarms during an alarm condition. 2. Silences an alarm before a known alarm condition occurs. 3. Resets an alarm after the alarm condition has been corrected.
Test Battery TEST	1. When the Test Battery switch is pressed, the Patient Pressure Meter shows the charge level of the battery currently in use. 2. Starts printer output activation.
Standby	Used to place the ventilator in the Non-ventilate State, disabling the delivery of air.
Ventilate	Enables the ventilator to deliver air to the patient.
Mode MODE	Causes the current ventilatory mode on the display to flash and allows the mode to be changed.
Setting Switches	
V_t	• Volume
T_i	• Inspiratory Time
SENS.	• Sensitivity
f	• Breath Rate
P	• Pressure
PEEP	• PEEP
P↓	• Low Pressure
P↑	• High Pressure
O_2%	• FIO_2 (Achieva PSO_2 only)
Menu/Escape MENU/ESC	Activates and deactivates the menu on the ventilator's display.
START/ENTER	Accepts the currently flashing parameter as the new setting. Activates display.
Up and Down Arrow Keys ▽ △	Increases or decreases the parameter settings or menu levels. Pressing when the sub menu is not active and a parameter has not been selected will cause the last alarm message to be displayed.

Settings	
Volume	50 ml to 2200 ml in 10 ml steps. For SIMV: 50 ml to 1750 ml in 10 ml steps. Accurate to ± 10 ml for 50-100 ml and ± 10% (max 75 ml) for 100 – 2200 ml.
Inspiratory Time	0.2 to 5.0 seconds in increments of 0.1 seconds. Accurate to ±10%.
Sensitivity	Flow: 3 to 25 LPM in 1 LPM increments. Accurate to ±2.0 LPM. Pressure: Off, 1 to 15 cmH_2O/hPa in 1 cmH_2O/hPa increments. Accurate to ±2.5 cmH_2O/hPa.
Breath Rate	1 BPM to 80 BPM in steps of 1 BPM. Accurate to ±10% or 1 BPM, whichever is greater.
Pressure	0 to 50 cmH_2O/hPa in 1 cmH_2O/hPa increments. Accurate to ±2.5 cmH_2O/hPa of the setting once the pressure reaches the setting. Pressure support settings below 3 cmH_2O/hPa default to 3 cmH_2O/hPa.
PEEP	0 and 3 to 20 cmH_2O/hPa in 1 cmH_2O/hPa increments. Accurate to ±2.5 cmH_2O/hPa.
Flow Acceleration	OFF or ON (Inspiratory flow $\leq$ 180 lpm)

Expiratory Trigger	15% to 55% in 10% increments. Accurate to ±15% at 15%, ±5% from 25% – 55%.
Low Pressure	1 to 59 cmH_2O/hPa in increments of 1 cmH_2O/hPa. Activates within ±2.5 cmH_2O/hPa.
High Pressure	2 to 80 cmH_2O/hPa in increments of 1 cmH_2O/hPa. Activates within ±2.5 cmH_2O/hPa.
O_2 Level (Achieva PSO_2 Only)	21% to 100% for tidal volumes greater than or equal to 100 ml, 21% to 70% for tidal volumes less than 100 ml in 1% increments. Accuracy: 50 to 90 ml, O_2 settings < = 70% ± 10% O_2; 100 to 2200 ml, O_2 settings <50%, ± 5% O_2, all other O_2 settings, ± 10% of settings. Supply pressures of less than 45 PSIG may result in reduced O_2 performance at some settings. Optimum performance is achieved at 65 PSIG O_2 supply pressure. It may take several minutes for the oxygen concentration to stabilize. The capacity of the O_2 blender is a function of tidal volume and inspiratory time, which in combination influence peak flow. As peak flows increases (large tidal volumes combined with short inspiratory times), the limit of the O_2 flow capacity is approached. The set O_2 concentration cannot be delivered if the flow capacity of the O_2 blender has been exceeded. To ensure the prescribed oxygen concentration is delivered to the patient, measure the delivered gases with a calibrated oxygen analyzer at all times.
Altitude	0 to 4500 meters in increments of 100 meters (or 0 to 14,760 feet in increments of 328 feet).
Connectors	
Modem Jack (Achieva PS or Achieva PSO_2)	RJ 11 phone connector to connect the optional internal modem to telephone lines.
Communications Port	RS-232 connector for Achieva Report generator computer, printer or external modem.
O_2 Inlet (Achieva PSO_2)	9/16 – 18, DISS 1240 THD.
External Battery Connector	3-pin male receptacle for 24 VDC input.
Power Entry Module	EIA dual fuse power entry module.
	Provides connections for hot, neutral, and grounded conductors.
	The receptacle incorporates fuses in the hot and neutral lines.
Inlet Filter	Intake for patient air. Screw off cap for filter change. 98% efficient at 0.3 microns.
Patient Pressure Port	Port for connection to the proximal pressure line of the patient circuit. For 3/16" I.D. tube.
Remote Alarm Connector	Connector for remote alarm.
Nurse Call Connector	Connector for Nurse Call Station.
Patient Air	22 mm O.D./15 mm I.D. ISO Fitting.
Exhalation Valve Port	Port for connection to the exhalation valve of the patient circuit. For 1/8" I.D. tube.

Environment	
Operating	5 °C to 40 °C (41 °F to 104 °F), 10% to 90% RH.
Storage	-20 °C to 50 °C (-4 °F to 140 °F), 10% to 90% RH.
	When moving the ventilator from a non-operating to an operating environment, allow a minimum of one hour temperature stabilization before use.
	When storing the ventilator, the battery must be recharged every thirty days. Storage above or below specified operating temperatures may affect battery life.
Miscellaneous	
Maintenance	Preventative maintenance must be performed by qualified personnel every 6000 operating hours or recertification every twelve (12) months, whichever occurs first.
Dimensions	10.75" x 13.30" x 15.60" (27.3 x 33.8 x 39.6 cm)
Weight	Less than 32 lbs.
Resistance Factor	Maximum of 4.5 cmH_2O/hPa @ 60 LPM
Compliance Factor	1.25 mL/hPa for A/C breaths 2.50 mL/hPa for Pressure Support breaths
Emergency Pressure Relief	90 ± 10 cm H_2O
Response time	75 milliseconds (under the following conditions): Resistance = 5 $cmH_2O/hPa/L/sec.$; Compliance = 50 $ml/cmH_2O/hPa$; Breath Rate = 20 BPM; Volume = 1500 ml; Pressure Support = 10 cmH_2O/hPa; PEEP = 5 cmH_2O/hPa. Response time varies inversely with the displayed flow rate, and directly with the selected trigger level.
Flow (average)	2.0 LPM to 180 LPM

The ventilator is intended to operate within its specifications if it is properly maintained and the service schedule is followed.

The ventilator is protected against electrostatic contact discharge of up to eight kilovolts (8 kV). Electrostatic discharge greater than eight kilovolts may damage the ventilator.

Standard compliance

The ventilator complies with the following international agency standards:

- IEC 601-1 Medical Electrical Equipment, 1988 Part 1: General Requirements for Safety*
- IEC 601-1-2 Medical Electrical Equipment, Part 1: General Requirements for Safety, Part 2: Collateral Standard - Electromagnetic Compatibility Requirements and Tests
- CAN/CSA-C22.2 No.601.1-M90 Medical Electrical Equipment Part 1: General Requirements for Safety*
- UL2601-1 Medical Electrical Equipment, Part I: General Requirements for Safety (1994)*

*Classified as Class I and internally powered; Type BF; drip proof, not suitable for use in the presence of flammable anesthetics, continuous operation.

9.3 Alarm Conditions

Low Pressure/Apnoea Alarms	
Low Pressure Alarm	
Visual Indicator	Low Pressure/Apnoea indicator P↓ will flash
Audible Alarm Tone	Five pulses.
Display screen	WARNING: Low Pressure. Attend to patient.
Cause	A low pressure alarm condition exists if the proximal pressure does not rise above the low pressure setting during the last two consecutive breath cycles. The exception is in SIMV mode when the Low Pressure setting is higher than the Pressure setting. Then the Low Pressure alarm will occur if the peak proximal pressure of the last two consecutive breaths never rises above the Low Pressure setting.
Latching Status	Latching/Non-Latching.
Valley Pressure Alarm	
Visual Indicator	Low Pressure/Apnoea indicator P↓ will flash.
Audible Alarm Tone	Five pulses.
Display screen	WARNING: Valley Pressure Alarm. Attend to patient.
Cause	A Valley pressure alarm condition exists if the proximal pressure does not drop below the low pressure setting during the last two consecutive machine breaths.
Latching Status	Latching/Non-Latching.
Exhale Fail Alarm	
Visual Indicator	Low Pressure/Apnoea indicator P↓ will flash.
Audible Alarm Tone	Five pulses.
Display screen	WARNING: Exhale Fail Alarm. Check exhalation valve.
Cause	An Exhale fail alarm condition exists when, at the start of the inspiratory cycle, the pressure in the patient's circuit is greater than or equal to the high pressure alarm setting.
Latching Status	Latching/Non-Latching.

Apnoea Alarm	
Visual Indicator	Low Pressure/Apnoea indicator P↓ will flash.
Audible Alarm Tone	Five pulses.
Display screen	WARNING: Apnoea Alarm. Check SENS setting.
Cause	An apnoea alarm condition exists when there is no patient breathing effort or machine cycle for 10 seconds while in Assist/Control Mode or 20 seconds in SIMV or Spontaneous modes.
Latching Status	Latching/Non-Latching.
User Self Test Error	
Visual Indicator	Low Pressure/Apnoea indicator P↓ will flash.
Audible Alarm Tone	Five pulses.
Display screen	Test ERROR. Refer to USER'S MANUAL.
Cause	A user self-test error condition exists if during the User Self Test the pressure in the patient circuit does not reach a sufficient level to perform the test.
Latching Status	Non-Latching.
Leak Test Failure Alarm	
Visual Indicator	Low Pressure/Apnoea indicator P↓ will flash.
Audible Alarm Tone	Five pulses.
Display screen	Leak test FAILED. Refer to USER'S MANUAL.
Cause	A leak test failure alarm condition exists when the patient circuit does not maintain the appropriate pressure or the exhalation valve fails to open and reduce the pressure in the patient circuit.
Latching Status	Non-Latching.

High Pressure Alarms	
High Pressure Alarm	
Visual Indicator	High Pressure indicator P↑ will flash
Audible Alarm Tone	Three pulses.
Display screen	WARNING: High Pressure Alarm. Attend to patient.
Cause	The pressure in the patient circuit exceeds the high pressure limit setting.
Latching Status	Non-Latching.
Relief Valve Test Failure	
Visual Indicator	High pressure indicator P↑ will flash.
Audible Alarm Tone	Three pulses.
Display screen	Relief valve test FAILED. Refer to USER'S MANUAL.
Cause	The relief valve failed to open while the pressure was above the relief valve threshold pressure.
Latching Status	Non-Latching.

Setting Error Alarms	
Invalid I:E Ratio Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Three pulses.
Display screen	WARNING: Invalid I:E ratio. Check settings.
Cause	A combination of settings (breath rate and inspiratory time) resulting in an inspiratory time that exceeds the expiratory time.
Latching Status	Non-Latching.
High Pres < Low Pres Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Three pulses.
Display screen	SETTING ERROR: High Pres < Low Pres setting.
Latching Status	Non-Latching.
Cause	The low pressure limit setting is the same or higher than the high pressure setting.
Volume Error Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Three pulses.
Display screen	WARNING: Volume error. Attend to patient.
Latching Status	Non-Latching.
Cause	With a volume breath the ventilator delivered a volume ±12% from the set volume.
Volume Error Alert	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	No audible alarm tone.
Display screen	WARNING: Volume error. Attend to patient.
Latching Status	Non-Latching.
Cause	With a pressure support breath the last two breaths did not stop within three seconds or: For a pressure control breath or a pressure support breath, the piston reached the end of travel on the last two breaths.

Rate Error	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Three pulses.
Display screen	WARNING: Breath rate error. Attend to patient.
Cause	In Assist/Control Mode, the last measured breath rate is 12% lower than the set breath rate, or: If the breath is a mandatory breath (SIMV mode), the time since the last breath is 12% greater than the Breath Rate setting, or: If the breath is an assisted breath (SIMV mode), the time since the last breath is 12% greater than two times the Breath Rate setting.
Latching Status	Non-Latching.
Pressure Differential Error Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Three pulses.
Display screen	Pressure Differential Error. Refer to manual.
Latching Status	Non-Latching.
Cause	The pressure levels detected by two independent sensors differ by more than 15 cmH_2O.
Inspiratory Error Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Three pulses.
Display screen	WARNING: Inspiratory error. Attend to patient.
Cause	During volume breath delivery the last measured inspiratory time differed by ±12% from the inspiratory setting.
Latching Status	Non-Latching.
Inspiratory Error Alert	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	No audible alarm tone.
Display screen	WARNING: Inspiratory error. Attend to patient.
Cause	During pressure-controlled breath delivery, the measured inspiratory time differed by ±12% from the inspiratory setting for the last two consecutive breaths.
Latching Status	Non-Latching.

Equipment Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	The alarm will beep for one second every 30 minutes during a minor fault.
	The alarm will beep once every fifteen minutes if the ventilator is currently ventilating and a serious fault is detected.
	The alarm will sound for three seconds if the ventilator is not ventilating and a serious fault is detected.
Display screen	Check Patient Circuit and Equipment.
Cause	An Equipment failure has been detected.
Latching Status	Non-Latching.
Vent Inop Alarm	
Visual Indicator	The Setting Error indicator ? will flash.
Audible Alarm Tone	Five pulses.
Display screen	WARNING: Equipment error. Refer to manual.
Cause	An Equipment failure has been detected.
Latching Status	Latching.

Oxygen Alarm (PSO_2 Only)	
Oxygen Alarm	
Visual Indicator	O_2 Fail indicator O_2 will flash.
Audible Alarm Tone	Three pulses.
Display screen	WARNING: Oxygen error. Attend to patient.
Cause	The O_2 Fail alarm will sound if the ventilator does not detect a flow source at the oxygen connector.
Latching Status	Non-Latching.

Power Switch-Over Alarm	
AC Source to External Battery Alarm	
Visual Indicator	Power Switch-Over indicator ~AC⇒🔋 will flash.
Audible Alarm Tone	Repeated single beep.
Display screen	Power source is now the external battery.
Cause	Power is switched from the AC power source to the external battery source.
Latching Status	Non-Latching.
AC Source to Internal Battery Alarm	
Visual Indicator	Power Switch-Over indicator ~AC⇒🔋 will flash.
Audible Alarm Tone	Repeated single beep.
Display screen	Power source is now the internal battery.
Cause	The ventilator switches from an AC power source to the internal battery.
Latching Status	Non-Latching.
External Battery to Internal Battery Alarm	
Visual Indicator	Power Switch-Over indicator ~AC⇒🔋 will flash.
Audible Alarm Tone	Repeated single beep.
Display screen	Power source is now the internal battery.
Cause	The ventilator switches from an external battery to the internal battery.
Latching Status	Non-Latching.

NOTE:

During Low Power conditions, other alarms (such as Setting Error) can occur when the ventilator is unable to deliver gases at the selected parameters.

Low Power Alarms	
Low Internal Battery Power	
Visual Indicator	Low Power indicator will flash.
Audible Alarm Tone	Single beep every five minutes
Display screen	WARNING: Low Internal Battery Power
Cause	The ventilator is powered from the internal battery and can provide approximately 45 minutes of operation with the current settings.
Latching Status	Non-Latching
Extremely Low Internal Battery Power	
Visual Indicator	Low Power indicator will flash.
Audible Alarm Tone	Three pulses. This tone can be silenced for five minutes by pressing the Alarm Silence/ Reset switch.
Display screen	WARNING: Extremely Low Internal Battery Power
Cause	The ventilator is powered from the internal battery and can provide approximately 10 minutes of operation with the current settings.
Latching Status	Latching
Battery Charge Depleted	
Visual Indicator	Low Power indicator will flash.
Audible Alarm Tone	Five pulses that cannot be reset or silenced.
Display screen	WARNING: Battery charge depleted.
Cause	The ventilator is powered from the internal battery and the internal battery's charge is depleted.
Latching Status	Latching

9.4 Troubleshooting

Warning

- If you suspect a problem with the ventilator or its accessories, attend to the patient first. If necessary, provide an alternate means of ventilation before attempting to troubleshoot the ventilator's problem.
- If you cannot determine the cause of the ventilator's problem, contact your equipment supplier. Do not use the ventilator until the problem has been corrected.

What you see and hear...	Why this might happen...	What you should do...
All indicators turn on and audible alarm sounds	The ventilator automatically self-tests the alarms each time it is turned on.	You do not need to do anything. The alarms should stop within two seconds.
	The ventilator is responding to a manual alarm test you are conducting.	You do not need to do anything. The alarms should stop within two seconds.
	Microprocessor error	1. Unplug the ventilator from external power. 2. Press and hold STANDBY ⏻ for three (3) seconds or more. 3. Reconnect external power. If the unit is connected to AC power, it will automatically exit low power standby mode and begin to charge the internal battery. Press VENTILATE to resume ventilation. If the unit is connected to a charged external battery, press the START/ENTER switch ↵ to restart. The internal battery will not begin to recharge until the ventilator is put into the ventilate mode. Press START/ENTER ↵ and check parameter settings for accuracy. Press VENTILATE. If alarm persists, unplug the ventilator and provide another means of ventilation.

What you see and hear...	Why this might happen...	What you should do...
Low Pressure/Apnoea Alarm	The patient is not breathing.	Check the patient for breathing effort and stimulate if necessary.
	There is water in the small-bore tubing.	Disconnect the small-bore tubing and remove the water per the manufacturer's instructions.
	Patient speech or other activities lower patient circuit pressure.	Low pressure alarm sounds whenever low pressure limit is not reached for two consecutive breaths. Review the chapter on alarms.
	There is a kink in the small-bore tubing.	Unkink and straighten the small-bore tubing.
	PEEP pressure is set higher than the Low Alarm control setting.	Set Low Alarm control setting higher than the PEEP pressure.
	There is a leak or loose connection in the large bore tubing of the patient circuit.	Check connection of the patient circuit to the ventilator; check all connections for leaks and tightness, especially at the humidifier, tracheal tube, and exhalation valve.
	The patient's breathing effort is less than the Sensitivity control setting.	Set the Sensitivity so the patient's breathing effort turns on the ASSIST/SPONTANEOUS indicator and call your clinician.
	The ventilator's Volume setting is set below patient's tidal volume.	Reset the Volume to the prescribed value. If values are correct, call your clinician.
	Incorrect control settings.	Reset all controls to the prescribed values. If values are correct, call physician.
	Obstructions in the patient pressure tube.	Check for leaks or kinks in the patient tubing.
	Other causes.	Notify your physician and your equipment supplier.
Low Power alarm	Failure to recharge the internal battery.	Plug ventilator into an AC power outlet.
		Plug ventilator into a charged external battery.
High Pressure Alarm	Water in the tubing.	Remove water from tubing.
	Crimped tubing.	Uncrimp tubing.
	Coughing or other high-flow expiratory efforts.	Treat patient's cough. The alarm is appropriate for these conditions.
	Patient inspiratory resistance or compliance changes.	Have physician determine new ventilator settings.
	Airway obstruction.	Check for tracheal obstruction or for a condition in which the patient requires sectioning.
	Malfunction in the exhalation manifold.	Replace the exhalation manifold.

What you see and hear...	Why this might happen...	What you should do...
Setting Error Alarm ?	Inappropriate setting or settings beyond the capabilities of the machine	Readjust settings to the clinician's prescription. If the settings are correct and the alarm persists, consult your clinician.
	Low battery power	Connect external power supply.
	See the Alarm chapter of this manual for more details.	
Green AC Power indicator does not glow ~AC	AC power cord is not connected.	Plug in the cord.
	The ventilator has blown a fuse.	Replace the fuse.
	No power to the wall outlet	Switch to an active outlet.
Unit will not operate on external battery power	Connection problem	Check all connections.
	Fuse(s) in battery system blown.	Replace blown fuse(s).
	Fuse inside vent is blown.	Return ventilator for service.
O_2 Fail Alarm 	Low O_2 source pressure. O_2 source disconnected. O_2 source empty.	Increase O_2 source pressure. Connect an O_2 source. Replace O_2 source.

CHAPTER 10

Warranty Information

10.1 Limited Warranty

Puritan Bennett Corporation warrants to the owner that the Achieva ventilators, exclusive of expendable parts and other accessories, shall be free from defects in material and workmanship for twenty-four months from the original date of sale. Puritan Bennett's sole obligation, with respect to any such defect, is limited to the repair or, at Puritan Bennett's option, replacement of the ventilator. Purchaser pays return freight charges.

This warranty is made on the condition that prompt notification of a defect is given to Puritan Bennett within the warranty period, and that Puritan Bennett has the sole right to determine whether a defect exists.

This warranty is conditional on the performance of Preventive Maintenance at a minimum of once every 6000 operating hours, or recertification every twelve (12) months (whichever occurs first) by service personnel qualified by Puritan Bennett. The warranty does not apply to ventilators that have been partially or completely disassembled; altered; subjected to misuse, negligence, or accident; or operated other than in accordance with the instructions provided by Puritan Bennett. This includes repair by trained personnel.

This warranty represents the exclusive obligation of Puritan Bennett and the exclusive remedy of the purchaser regarding defects in the ventilator.

THIS WARRANTY IS GIVEN IN LIEU OF ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

No person is authorized to modify, in any manner, Puritan Bennett's obligation as described above.

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